Y 3. At 7: 16/18 -10

NUCLEAR SCIENCE ABSTRACTS

MIAMI UNIVERSITY LIBRARY

Volume 18 Number 10

Abstracts 15733–17375

May 31, 1964

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Davis, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Boulder, University of Colorado
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library
East Lansing, Michigan State University

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Las Vegas, Nevada Southern University
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University
Teaneck, Fairleigh Dickinson University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Albany, The University of the State of New York
Buffalo, State University of New York at Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, New York University
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Public Library of Charlotte and Mecklenburg County
Durham, Duke University
Raleigh, North Carolina State College

NORTH DAKOTA
Grand Forks, University of North Dakota

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library

OHIO (CONT.)
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Norman, University of Oklahoma
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State University
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennesse
Memphis, Public Library
Nashville, Joint University Libraries
Oak Ridge, Oak Ridge Institute of Nuclear Studies

TEXAS
Austin, University of Texas
College Station, Texas A & M University
Dallas, Southern Methodist University
Houston, Rice University
Lubbock, Texas Technological College
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia
Norfolk, Old Dominion College

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

Volume 18, Number 10, May 31, 1964

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Division of Technical Information, Edward J. Brunenkant, Director. Published by the USAEC Division of Technical Information Extension, Robert L. Shannon, Extension Manager.

Nuclear Science Abstracts covers the international literature on nuclear science and technology and provides the only comprehensive abstracting and indexing of this body of information. Published twice each month since 1947, *NSA* covers technical reports of the U. S. Atomic Energy Commission and its contractors, technical reports of U. S. Government agencies and other governments, universities, industrial and research organizations, as well as patents, books, and journal literature on a world-wide basis. More than 250,000 abstracts have appeared in *NSA* through Volume 17. The subject matter covered in *NSA* is described in detail in Report TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Abstracts are arranged according to a number of subject categories and subcategories. Definitions of categories appear in Issues No. 1 and 13. If the language of the original item is not English, the language will be indicated. Translations are not abstracted where an abstract of the original item has appeared in *NSA*.

INDEXES TO NSA

Subject, personal author, corporate author, and report number indexes appear in each issue and are cumulated quarterly, semiannually, and annually. The cumulative report number index annually cumulates all report numbers in all volumes.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

The public availability of all U. S. Atomic Energy Commission reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations taken from *Dissertation Abstracts* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

Most of the published literature abstracted in *NSA* is on deposit at the Oak Ridge Institute of Nuclear Studies Library, Oak Ridge, Tennessee, (a USAEC depository library) and is available through interlibrary loan. When requesting papers from this source, it is important that *NSA* volume and abstract number be cited.

HOW TO OBTAIN NUCLEAR SCIENCE ABSTRACTS

NSA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Government agencies may obtain *NSA* free of charge.

NSA is available to the general public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., as follows:

For the 24 regular issues, $30.00 domestic, $37.00 foreign. A single issue costs $1.75, plus 25 per cent for foreign mailing. Domestic rates apply to the United States, Canada, Mexico, and Central and South American countries except Argentina, Brazil, British and French Guiana, Surinam, and British Honduras. Foreign rates apply to the countries excepted above and to all other countries throughout the world.

For the quarterly, semiannual, and annual indexes, $22.00 domestic, $25.00 foreign.

Multivolume subject and author indexes are available as follows:

Vols. 1–4 (1948–1950) Johnson Reprint Corporation, 111 Fifth Avenue, New York, N. Y. 10003, $30.00.

Vols. 5–10 (1951–1956) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $5.25.

Vols. 11–15, Subjects, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $19.00.

Vols. 11–15, Personal Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $14.25.

Vols. 11–15, Corporate Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $2.50.

Annual Indexes are available separately from the U. S. Government Printing Office as follows:

Vol. 16, Subject and Authors, $9.75.

Vol. 17, Subject and Authors, $12.25.

Cumulative Report Number, $5.25.

ACKNOWLEDGMENTS

Agreements between the United States Atomic Energy Commission and the following organizations with regard to providing continuing services and specific literature coverage for *Nuclear Science Abstracts* are gratefully acknowledged:

American Institute of Physics; Atomic Energy of Canada Limited; Atomic Energy Research Establishment, United Kingdom; European Atomic Energy Community (EURATOM); Gmelin Institute; International Atomic Energy Agency; Japan Atomic Energy Bureau—Japan Atomic Energy Research Institute; Netherlands Patent Office; Reactor Centrum Nederland.

TABLE OF CONTENTS

Volume 18, Number 10, May 31, 1964

Category	*Page*
BIOLOGY AND MEDICINE	2101
General	2101
Ecology	2103
Metabolism, Tissue Distribution, and Toxicology	2104
Radiation Effects	2109
Radiation Effects Therapy and Countermeasures	2128
Radiation Hazards and Protection	2130
Radiotherapy and Radiodiagnosis	2130
CHEMISTRY	2138
General	2138
Analytical Procedures	2138
Inorganic and Physical Chemistry	2144
Organic Chemistry	2153
Radiation Chemistry and Radiochemistry	2154
Separation Processes and Procedures	2161
ENGINEERING	2166
General	2166
Applications of Nuclear Explosions	2166
Facilities and Equipment	2167
Heat Transfer and Fluid Flow	2168
Materials Testing	2170
Vacuum Engineering	2171
GEOLOGY AND MINERALOGY	2172
General	2172
Natural Radioactivity and Fallout	2173
Techniques and Equipment	2175
Thorium and Uranium Minerals	2176
HEALTH AND SAFETY	2177
INSTRUMENTATION	2187
General	2187
Radiation Detection	2188
ISOTOPE TECHNOLOGY	2199
General	2199
Industrial Applications	2199
Power Application	2201
Separation and Production	2201
MATHEMATICS AND COMPUTERS	2203
METALS, CERAMICS, AND OTHER MATERIALS	2205
General	2205
Corrosion	2207
Fabrication	2209
Properties and Structure	2210
Radiation Effects	2218
METEOROLOGY	2222
PHYSICS	2223
General	2223
Accelerators	2226
Astrophysics and Cosmology	2230
Atomic Physics	2232
Cosmic Radiation	2244
Criticality Studies	2244
Direct Energy Conversion	2245
Elementary Particles and Radiations	2246
Field Theory and Quantum Mechanics	2251
Geophysics	2254
Low Temperature Physics	2262
Neutron Physics	2264
Nuclear Properties and Reactions	2265
Plasma Physics and Thermonuclear Processes	2284
Shielding	2302
REACTOR TECHNOLOGY	2304
General	2304
Auxiliaries and Components	2305
Criticality Studies	2307
Design and Feasibility	2308
Fuels	2309
Power and Power-Breeder Reactors	2310
Process Heat Reactors	2311
Production Reactors	2312
Propulsion and Space	2312
Research and Test Reactors	2313
WASTE DISPOSAL AND PROCESSING	2314
GENERAL AND MISCELLANEOUS	2318
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-11
SUBJECT INDEX	INDEX-48
REPORT NUMBER INDEX	INDEX-117

Managing Editor

John W. Norris

Assistant Managing Editor

Donald D. Davis

Associate Editor

Robert C. Kelly

Production Editor

Lawrence T. Whitehead

Technical Editor

David E. Bost

Subject Index Editor

Everett J. Hoffman

Evaluators

William D. Matheny
John H. Mitchell
Mary H. Newman
Lee M. Thompson

Subject Authority Editor

Thomas R. Henley

Corporate Authority Editor

Clara L. Fox

Abstractors

D. Lamar Cason
James R. Dulaney
Helen M. Gant
Bernard O. Griggs
Mary Catherine Grissom
Miriam P. Guthrie
Phyllis Hansen
Thomas F. Heagerty
Carolyn D. Houston
Rose V. Jermain
Julia Redford
Ned W. Rizzardi
Charles E. Stuber
Robert E. Upchurch
Anne G. Ward
David C. West

Report Code Authority

Hannah B. Mayfield

Exchanges

Margaret L. Pflueger

Scheduling and Publishing Coordinator

Henry H. Lansford

Communication concerning the editorial policy and content of *NSA* should be addressed to the Managing Editor, *Nuclear Science Abstracts*, AEC Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, May 20, 1963.

Volume 18, Number 10 May 31, 1964

NUCLEAR SCIENCE ABSTRACTS

BIOLOGY AND MEDICINE

General

15733 (ACRH-20) SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. (Argonne Cancer Research Hospital, Chicago). Sept. 1963. Contract AT(11-1)-69. 147p.

Fifteen papers are included; separate abstracts have been prepared for eight. Seven papers were previously abstracted in NSA. (H.M.G.)

For abstracts of individual papers see: 15734, 15749, 15750, 15751, 15752, 15755, 15763, and 15912.

15734 (ACRH-20(p.37-46)) PERCUTANEOUS CORDOTOMY FOR PAIN. S. Mullan, P. V. Harper, J. Hekmatpanah, H. Torres, and G. Dobben (Chicago. Univ.).

This is taken from paper appearing in J. Neurosurg., Jan. 1964.

Neurosurgical techniques used in anterolateral cordotomy for pain at the University of Chicago are described. Examples are presented from the 42 patients receiving cordotomy. Effective cordotomies were performed in 34 of the 42 patients. Complications arising from cordotomy and reasons for failure of the technique are discussed with reference to particular cases. (H.M.G.)

15735 (ARCRL-10) ANNUAL REPORT [ON RADIOBIOLOGY], 1962-63. (Gt. Brit. Agricultural Research Council. Radiobiological Lab., Wantage, Berks, England). 117p.

Results are presented from measurements of the content of ^{131}I, ^{90}Sr, ^{137}Cs, ^{89}Sr, and ^{140}Ba in foodstuffs sampled in the United Kingdom during 1962. Data are included on the radioactivity in milk consumed in the Republic of Ireland and flour produced in Australia. The maximum level of ^{90}Sr in the diet of individuals from selected areas was calculated. Data are included from measurements of ^{90}Sr and ^{137}Cs in permanent pastures and experimental studies of factors affecting the uptake of fission products by plants from soil, and tracer studies on the distribution of herbicides in soil. (C.H.)

15736 (LAMS-3034) BIOLOGICAL AND MEDICAL RESEARCH GROUP (H-4) OF THE HEALTH DIVISION ANNUAL REPORT, JULY 1962 THROUGH JUNE 1963. (Los Alamos Scientific Lab., N. Mex.). July 1963. Contract W-7405-eng-36. 374p.

Separate abstracts were prepared for 39 sections of this report. One section was abstracted previously and appeared in NSA as LADC-5323 (NSA 16: 31472). A list is included of publications during the period covered by the report. (C.H.)

For abstracts of individual sections see: 15737, 15738, 15739, 15740, 15741, 15742, 15743, 15744, 15745, 15764, 15765, 15766, 15767, 15768, 15769, 15770, 15771, 15772, 15773, 15774, 15775, 15776, 15777, 15778, 15779, 15780, 15807, 15808, 15809, 15810, 15811, 15812, 15953, 15954, 16224, 16300, 16301, 16302, and 16303.

15737 (LAMS-3034(p.168-79)) COMPUTER PROGRAMS FOR ANALYZING DATA. P. N. Dean (Los Alamos Scientific Lab., N. Mex.).

FORTRAN II programs were written for use in analyzing data from biological tracer studies with the IBM 7090 computer. These included the HAV-8 program to investigate optimum counting times for maximum statistical accuracy using the Humco II whole-body γ spectrometer; SUM-1 and SUM-2 programs for preliminary analysis of data from whole-body counting; PBR-2 and PBR-3 programs to compute biological retention; RTW-2 to compute retention, elapsed time, and weighting factor based on counting statistics; MWt-1 to compute the molecular weight of the DNA molecule using data from the analytical ultracentrifuge; and the IQ-2 to compute isotope quantity from complex γ spectra. (C.H.)

15738 (LAMS-3034(p.227-34)) PROGRESS IN THE ESTABLISHMENT OF KARYOGRAPHIC METHODS AS A TOOL IN RADIOPATHOLOGY. G. L. Humason and P. C. Sanders (Los Alamos Scientific Lab., N. Mex.).

A procedure is described for the preparation of blood samples from Macaca mulatta and M. speciosa for cytogenetic analysis and statistical correlation with radiation doses. Results are reported from chromosome analyses of blood cells from these two species. (C.H.)

15739 (LAMS-3034(p.235-52)) ELECTRONIC MEASUREMENT OF CELLULAR VOLUMES. IV. DETERMINATION OF SCALING AND CORRECTION FACTORS FOR CONVERSION OF VOLTAGE TO CUBIC MICRONS. C. C. Lushbaugh, D. B. Hale, and N. J. Basmann (Los Alamos Scientific Lab., N. Mex.).

A method is described for the calibration of a particle volume analyzer system assembled around a Coulter electronic particle counter and the development of scaling factors to convert pulse height voltage into cubic microns for measurement and distribution studies on cells varying in size from bacteria to the largest HeLa cells. (C.H.)

15740 (LAMS-3034(p.253-60)) ELECTRONIC MEASUREMENT OF CELLULAR VOLUMES. V. CHANGE IN RED BLOOD CELLS RESULTING FROM NON-PHYSIOLOGIC pH. C. C. Lushbaugh, E. C. Anderson, H. I. Israel,

D. B. Hale, and N. J. Basmann (Los Alamos Scientific Lab., N. Mex.).

The reported increased size of erythrocytes suspended in saline is due to an effect of the low pH of unbuffered saline solutions commonly used in electronic particle counters. This increase in size was found to occur exponentially with decrease in pH and to be 10.6 and 12.5% per pH unit below 7.4 for man and mouse, respectively. (auth)

15741 (LAMS-3034(p.261-9)) ELECTRONIC MEASUREMENT OF CELLULAR VOLUMES. VI. ELECTRONIC IMPROVEMENT OF COULTER COUNTER RESOLUTION. C. C. Lushbaugh, N. J. Basmann, and D. B. Hale (Los Alamos Scientific Lab., N. Mex.).

Improvements in the electronic system of a Coulter counter that improved resolution during studies of erythrocyte size are described. (C.H.)

15742 (LAMS-3034(p.270-8)) ELECTRONIC MEASUREMENT OF CELLULAR VOLUMES. VII. BIOLOGIC EVIDENCE FOR TWO VOLUMETRICALLY DISTINCT SUBPOPULATIONS OF RED BLOOD CELLS. C. C. Lushbaugh and D. B. Hale (Los Alamos Scientific Labs., N. Mex.).

Taking advantage of the well-known facts that red blood cell (RBC) sensitivity to hemolysis by saponin increases with RBC aging and that parenterally administered ^{59}Fe labels RBC only as they are produced, experiments were done which showed that hemoglobin released by saponin destruction of the two subpopulations of RBC was unlabeled when only the smaller volumed RBC of population A were lysed. The ^{59}Fe label was found in the larger volumed RBC of population B. These findings are considered biologic evidence for the existence of two distinct subpopulations of RBC and for the belief that the bimodal frequency distribution curve of RBC volumes obtained with the LASL cell volume analyzer system is not artifactual. It is suggested, therefore, that these subpopulations be renamed as mature and immature RBC, rather than A and B. (auth)

15743 (LAMS-3034(p.279-85)) ELECTRONIC MEASUREMENT OF CELLULAR VOLUMES. VIII. VOLUMETRIC CHANGE OF CIRCULATING ERYTHROCYTES IN WW^{v} GENETICALLY ANEMIC MICE IMPLANTED WITH w+w+ FETAL LIVER. C. C. Lushbaugh and E. S. Russell (Los Alamos Scientific Lab., N. Mex.).

The distribution of erythrocyte volumes was studied with electronic equipment in anemic, donor, and chimeric mice resulting from the implantation of fetal liver. Results indicate that after successful implantation the chimeric blood was derived entirely from the implant even though nothing was done experimentally to destroy the genetically determined macrocytic marrow of the host. (C.H.)

15744 (LAMS-3034(p.307-11)) CHROMOSOMES IN TRANSPLANTED LEUKEMIA OF AKR MICE. I. U. Boone and P. M. LaBauve (Los Alamos Scientific Lab., N. Mex.).

Chromosome counts made on cells from the bone marrow of normal and leukemic mice were compared. Although there was a greater heterogeneity in the distribution of chromosome number in the leukemic mice, the modal value remained that of the normal mouse. The results show that transplantable neoplastic cells can have a diploid chromosome complement and remain diploid over a long series of transfers. (C.H.)

15745 (LAMS-3034(p.326-8)) THE REPRESENTATION OF OLIGONUCLEOTIDES: A SUB-NOMENCLATURE PROBLEM. F. N. Hayes and D. G. Ott (Los Alamos Scientific Lab., N. Mex.).

A system of sub-nomenclature is described for oligonucleotides. (C.H.)

15746 (TID-7689(p.50-1)) USE OF S^{35} ACETAZOLAMIDE AND OTHER LABELED DRUGS IN THE STUDY OF BLOOD BRAIN BARRIER CHANGES. V. Nair and L. J. Roth (Chicago, Univ.).

Acetazolamide labeled with ^{35}S was used in studies of the blood brain barrier and changes in it due to the effects of ionizing radiation, metrazol seizure, osmotic imbalance, anoxia, and carbon dioxide acidosis. White rats were used in the studies. Radioactive tracers were found to show greater sensitivity than dye methods. (M.C.G.)

15747 (TID-7689(p.52-4)) USE OF ISOTOPES TO ESTABLISH A METHOD FOR DETERMINING THE PERMEABILITY CHARACTERISTICS OF THE PULMONARY MEMBRANE. Aubrey E. Taylor, Arthur C. Guyton, Vernon S. Bishop, and Kirby B. DeLozier (Mississippi, Univ., Jackson, Medical Center).

Studies using radioisotopes were designed to obtain further information on the permeability characteristics of the pulmonary membrane. The lower left lobe of the dog was removed and perfused with a buffered 5% dextran-Tyrode's solution, and the lung was filled with Tyrode's solution. The perfusing system contained a small reservoir into which the venous portion of the system emptied. An isotope or other material could be introduced into this reservoir and its disappearance followed by serial sampling. The data obtained by utilizing isotope procedures (with ^{24}Na) yielded 3 results: a value for interstitial volume, the volume of fluid in the lung that is actually changing solutes with the perfusing system, and support for the hypothesis that the pulmonary membrane acts as if it were a cellular type membrane. (M.C.G.)

15748 (TID-7689(p.69-72)) USE OF RADIOISOTOPES IN MARINE BIOLOGICAL RESEARCH. Thomas W. Duke (Fish and Wildlife Service, Radiobiological Lab., Beaufort, N. C.).

The uses of radioactive tracers in marine biology studies of marine organisms and sediments, foods and feeding, productivity, and biogeochemical cycling of trace metals are discussed. (M.C.G.)

15749 LEUKEMIA AMONG CHILDREN IN A SUBURBAN COMMUNITY. C. W. Heath, Jr., and R. J. Hasterlik (Boston City Hospital). Am. J. Med., 34: 796-?(1963). (ACRH-20(p.1-24))

Between the autumn of 1957 and the summer of 1960 eight cases of leukemia were diagnosed among children living in the town of Niles, a suburb of Chicago in Cook County, Illinois. These cases represented for this town a significantly increased annual incidence of leukemia among children, 21.3 cases per 100,000 in Niles compared with 4.6 cases per 100,000 in the remainder of Cook County (Table 1). The clinical and epidemiologic features of this unusual concentration of leukemia cases are presented. Each of the eight children with leukemia in Niles lived in the same residential neighborhood. Seven of the eight children were from Roman Catholic families, and each of these seven children attended or had older siblings who attended the single parochial grade school in the parish. The eight cases occurred in a particular time pattern, and they were accompanied by the parallel appearance of a rheumatic-like illness among other children attending school. No common factor was found to provide an explanation for the occurrence of these eight cases of leukemia. Their epidemio-

logic characteristics, however, suggest a relationship to infectious processes, in addition to providing material of general interest for the study of leukemia. (auth)

15750 METASTATIC CARCINOMA OF PARATHYROID AND PERSISTENT HYPERPARATHYROIDISM. A. W. Lazar, R. L. Landau, and A. Kappas (Univ. of Chicago). Arch. Pathol., 72: 484-?(1961). (ACRH-20(69-75))

A case of carcinoma of the parathyroid is described. The hyperparathyroidism persisted after removal of the primary tumor and in the absence of local recurrence. The usual sequelae to prolonged hyperparathyroidism were present; in addition there was an islet-cell adenoma and duodenal ulcer. The metastatic pattern differs from other reported cases. (auth)

15751 INHIBITION OF RNA POLYMERASE BY 6-AZAURIDINE TRIPHOSPHATE. I. H. Goldberg and M. Rabinowitz (Argonne Cancer Research Hospital, Chicago). Biochim. Biophys. Acta, 72: 116-?(1963). (ACRH-20(p.132-5))

Escherichia coli RNA polymerase was prepared, and the synthetic reaction was assayed by the method of Chamberlin and Berg. Phosphorus-32-labeled uridine triphosphate (UTP) was used as the proximally labeled nucleotide. The pyrophosphate-nucleoside triphosphate exchange reaction dependent on crab-daT(deoxyadenylate and thymidylate) (or daT synthesized by Kornberg's polymerase) was maximal when UTP alone was included in the reaction. Labeled pyrophosphate-UTP exchange was significantly inhibited by aza-UTP. (H.M.G.)

15752 EFFECTS OF STEROID SEX HORMONES ON IMMUNOLOGICAL PHENOMENA. A. Kappas, H. E. H. Jones, and I. M. Roitt (Middlesex Hospital. Courtauld Inst. of Biochemistry, London). Nature, 198: 902-?(1963). (ACRH-20(p.86-8))

Continued administration of oestrone to female guinea pigs injected with homologous thyroglobulin in complete Freund's adjuvant greatly diminished the intensity of induration of the delayed skin reactions to both tuberculin and thyroglobulin. The erythematous reactions to thyroglobulin were not depressed, and this may be related to the lack of effect of oestrone treatment on circulating antibody titres in the animals. Comparable experiments in female rats involving the production of auto-allergic thyroiditis gave more variable results: oestrone markedly reduced the severity of thyroid lesions in three experiments but was without effect in two others. The tuberculin responses were more consistently affected and, despite the difficulty of grading the skin reaction in this species, the results were indicative of a similar trend to that seen in the guinea pig. An immuno-suppressive effect was also observed in rats with testosterone which clearly inhibited the development of auto-allergic thyroiditis in males and reduced the incidence and severity of adjuvant arthritis in both males and females. It remains to be seen whether these effects are related to the hormonal nature of the steroids or to a property of the molecular structure independent of their classical hormonal actions. The sex hormone effects on experimental adjuvant arthritis may have clinical implications and this possibility is being investigated. (auth)

15753 INHOMOGENEITY OF DOSE DISTRIBUTION IN ANIMALS SUBJECTED TO WHOLE-BODY IRRADIATION WITH 250-kvp X-RAYS. Stanley J. Malsky, Charles G. Amato, Victor P. Bond, James S. Robertson, and Bernard Roswit (Brookhaven National Lab., Upton, N. Y.). Radiation Res., 21: 462-72(Mar. 1964). (BNL-7304)

Even though bilateral or more complicated exposure procedures are of considerable importance in total-body exposure of large animals or man, these measures may not result in even approximately the same dose to different tissues. Because of body contour, depth-dose patterns determined in a rice-and-wax phantom contoured to the shape of a dog were appreciably different from values calculated from published standard depth-dose tables (400-cm^2 portal, other factors being approximately equal). In addition to differences due to contour, the tissue traversed by the beam makes considerable difference. Depth-dose patterns in a cadaver dog, compared with those in a contoured rice phantom, differed by as much as ±30%. (auth)

15754 IMMUNOPATHOLOGY. IIIrd International Symposium Held at Scripps Clinic and Research Foundation, La Jolla, California, January 1963. Pierre Grabar and Peter A. Miescher, eds. Basel, Schwabe & Co., 1963. 389p.

Twenty-six papers were presented on the following general topics: structure and genetics of immune globulins; antibody formation; influence of various factors on antibody response; mechanisms of immunogenic kidney diseases; and mechanisms of blood cell damage produced by immunological reactions. (H.M.G.)

15755 FEVER-PRODUCING ACTION OF STEROIDS. R. H. Palmer and A. Kappas (Argonne Cancer Research Hospital, Chicago). p.101-? of "The Medical Clinics of North America." Philadelphia, W. B. Saunders Co., 1963. (ACRH-20(p.76-85))

The in vivo metabolism of cholesterol and adrenocortical and gonadal hormones leads to the formation of a large number of steroid metabolites having potent fever-producing, hemolytic and cytotoxic properties. The pyrogenic activity of such metabolites was implicated in the pathogenesis of fever in periodic disease. Hemolytic and cytotoxic properties may participate also in the mechanism of other febrile and inflammatory disorders. (auth)

15756 RADIATION, RADIOACTIVITY, AND INSECTS. R. D. O'Brien and L. S. Wolfe. Monograph Series on Radiation Biology. New York, Academic Press, 1964. 221p. $5.75.

The anatomy and physiology of insects and applications of radiation and radioisotopes in entomology are reviewed. The effects of radiation on insects, labeling methods, insect control by radiation, tracer studies of insecticide metabolism, and the advantages of insects as experimental animals for radiobiological studies are discussed. (473 references.) (C.H.)

Ecology

15757 (TID-7689(p.62-5)) INTERSPECIFIC TRANSFER OF Ca^{45} AND P^{32} BY ROOT SYSTEMS. Frank W. Woods and Kirby Brock (Duke Univ., Durham, N. C. School of Forestry and Forest Service, Aiken, S. C.).

Studies were made of the phenomenon of mineral transfer in forest stands through roots using ^{45}Ca and ^{32}P tracers. Experiments were carried out in a mixed hardwood forest stand near Durham, N. C., in the summer of 1963. Red maples in the center of 5 plots were selected as donor trees. These trees were cut and cups were fashioned around their stumps with modeling clay. Five millicuries of either ^{32}P or ^{45}Ca were placed in each cup in water solution and the cups covered. Foliar samples were taken from the trees in each plot 2, 4, 6, and 8 days after the introduction of isotopes. Samples were counted to determine if ^{45}Ca or ^{32}P was

present. Either ^{32}P or ^{45}Ca was transferred from the red maple donors via roots to a total of 19 species with no apparent selectivity, indicating that exchange was random and occurred when roots were in opportunistic juxtaposition. (M.C.G.)

15758 (TID-20347) PROGRESS REPORT [ON RADIOACTIVITY IN MARINE ENVIRONMENT, 1963]. Bruno Schreiber (Parma, Italy. Università). [1963]. Contract IAEA 62/US. 20p.

Data are presented from measurements of the gross β activity, γ spectra, and ^{90}Sr content of plankton samples collected during 1961, 1962, and 1963 in the Ligurian and Adriatic Seas. Collections were made at various depths for studies of species, biomass, chemical composition, and radioactivity. Procedures were developed for ^{90}Sr extraction from plankton and other marine biological materials. Data are included on the ^{90}Sr content in cuttlebone of the Ligurian and Adriatic Seas. A list of publications during the period covered by this report is included. (C.H.)

15759 (TID-20366) STUDIES ON THE ECOLOGY OF ACANTHARIA IN RELATION TO THE CIRCULATION OF Sr IN THE SEA. Progress Report. Bruno Schreiber (International Atomic Energy Agency, Vienna). [1963]. Contract AT(30-1)-267. 31p.

The content of inorganic salts of Sr in the skeleton of Acantharia was determined. From the results of the chemical analysis and from the counting of Acantharia in plankton from various locations, a positive correlation was found between Sr and Acantharia in plankton. Plankton collected from various locations in the Mediterranean Sea during 1960 through Sept. 1963 was analyzed for ^{90}Sr content. Analytical procedures are discussed. Measurements were also made on the ^{90}Sr content in sea water and cuttle fish bones collected during the same period of time. Attempts to breed Acantharia in the laboratory and the preparation of autoradiograms of Acantharia are described. Sediments from the Ligurian coastal sea bottom were analyzed for gross β radioactivity. (C.H.)

15760 WEIGHTS OF COTTON RATS IN RELATION TO SEASON, BREEDING, AND ENVIRONMENTAL RADIOACTIVE CONTAMINATION. P. B. Dunaway and S. V. Kaye (Oak Ridge National Lab., Tenn.). Am. Midland Naturalist, 71: 141-55(Jan. 1964).

Monthly body weights of cotton rats, Sigmodon hispidus komareki, over a two-year period in radioactive and nonradioactive areas showed detailed changes in relation to season and reproduction. The population of major interest was resident on the radioactive dry bed of the former White Oak Lake, Roane County, Tennessee. The other population lived on a nearby uncontaminated old field. Weight was not a useful index to age, especially during cold weather when animals either gained weight slowly or lost weight. Average weights of females were greater than average weights of males during much of the breeding season, but males were heavier than females during nonbreeding periods and during the first few months of the breeding season. The incidences of descended testes and pregnancies, and the rate of weight gain increased with each year during months of favorable weather. The cotton rats of both areas were extirpated after a period of unusually cold weather and heavy snows. Possible effects of radiation on weights and breeding condition of White Oak Lake-bed cotton rats could not be demonstrated unequivocally on the basis of the criteria studied. It was concluded that if possible effects are to be demonstrated, a study will have to be continued for many years on a routine basis until the populations have gone through several cycles of abundance in order to separate effects of natural environmental stresses from effects of low-level radiation. (auth)

15761 SORPTION AND DISTRIBUTION OF Sr^{90} AND Cs^{137} IN THE WHEAT FROM A CONTAMINATED SOIL. L. Argiero, G. Del Corso, S. Manfredini, and G. Palmas (CAMEN, Pisa, Italy). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 161-4(1963). (In French)

In order to study the sorption of Sr^{90} and Cs^{137} by wheat at different stages of growth, some seeds were sown in little cases filled with earth materials containing various quantities of Ca and K. At different stages of growth, the earth materials containing various quantities of Ca were contaminated with Sr^{90}, the earth materials containing different quantities of K were contaminated with Cs^{137}. Plant samples were taken at different stages of their growth, and their radioactivity was measured. (auth)

15762 LANDSCAPE INVESTIGATIONS USING CAESIUM-137. S. I. Auerbach, J. S. Olson, and H. D. Waller (Oak Ridge National Lab., Tenn.). Nature, 201: 761-4 (Feb. 22, 1964).

An experiment is described in which tracer quantities of Cs^{137} were used in a relatively large-scale field investigation. A forest ecosystem tagged with Cs^{137} was used: to determine cesium cycles and rates of cycling in a mesic forest ecosystem; to measure cesium transfer between components of an ecosystem and apply these results to a theoretical model of element circulation; and to derive information useful for predicting the fate of problem radionuclides in those ecosystems potentially having a large capacity for storage in biological materials. The site chosen was a sinkhole habitat forested by Liriodendron tulipifera. Methods used for dose determination, inoculation of trees, avoiding undesirable contamination, and sampling of the forest are described. Seasonal variations in isotope distribution are discussed. Preliminary results emphasize the importance of rain as an agent in radiocesium transfer. Approximately 20 percent of the total litter burden was derived from rain leaching. Seven percent of the original radiocesium input to Liriodendron was transferred to the forest floor during the first growing season. (H.M.G.)

Metabolism, Tissue Distribution, and Toxicology

15763 (ACRH-20(p.136-43)) A SMALL-ANIMAL SCANNING SYSTEM. R. N. Beck and D. B. Charleston (Argonne Cancer Research Hospital, Chicago).

This paper appears in Intern. J. Appl. Radiation Isotopes.

An experimental small animal scanner capable of producing a relatively high resolution photograph of the distribution of gamma emitting isotopes was constructed. The system produces a profile graph of the distribution, and a measure of the total radioactivity in the animal. (auth)

15764 (LAMS-3034(p.21-33)) RETENTION OF INTRAVENOUSLY ADMINISTERED CESIUM^{132} BY MAN. C. R. Richmond, J. E. London, and J. E. Furchner (Los Alamos Scientific Lab., N. Mex.).

Increasing use of short-lived ^{132}Cs (6.5-day physical half life) for calibration of whole-body counting facilities affords additional opportunities for measuring biological turnover of Cs by human subjects. The gamma-ray energy of ^{132}Cs is remarkably similar to that of 28-yr ^{137}Cs

(i.e., 0.67 and 0.66 Mev, respectively), thus allowing the substitution of ^{132}Cs for in vivo calibration experiments. Preliminary results are presented from measurements of the effective retention of ^{132}Cs by four normal young adult subjects. (C.H.)

15765 (LAMS-3034(p.34-40)) LACK OF EFFECT OF EXERCISE ON THE EXCRETION OF CESIUM^{137} IN MICE. J. E. Furchner, C. R. Richmond, and G. A. Trafton (Los Alamos Scientific Lab., N. Mex.).

It was demonstrated that the excretion rate of ^{137}Cs in mice is inversely related to environmental temperatures but that it was not affected by enforced exercise. (C.H.)

15766 (LAMS-3034(p.41-8)) DISTRIBUTION OF CESIUM^{137} IN MICE AND DOGS AFTER CHRONIC EXPOSURE. J. E. Furchner, C. R. Richmond, and G. A. Trafton (Los Alamos Scientific Lab., N. Mex.).

The whole-body activity in mice and dogs during chronic exposure to ^{137}Cs and the distribution in tissues after such chronic exposure were measured. Results showed that the bone metabolism of the two species differs in respect to ^{137}Cs. (C.H.)

15767 (LAMS-3034(p.49-52)) METABOLISM OF MANGANESE^{54} IN RATS AND MICE. J. E. Furchner, C. R. Richmond, and G. A. Trafton (Los Alamos Scientific Lab., N. Mex.).

The retention of ^{54}Mn in rats and mice was followed by whole-body counting after oral, intraperitoneal, and intravenous administration. Preliminary results showed wide variability of retention. (C.H.)

15768 (LAMS-3034(p.53-8)) RETENTION OF ZIRCONIUM^{95} AFTER ORAL AND INTRAPERITONEAL ADMINISTRATION TO MICE. J. E. Furchner, C. R. Richmond, and G. A. Trafton (Los Alamos Scientific Lab., N. Mex.).

The retention of ^{95}Zr in mice after oral and intraperitoneal administration was followed by whole-body counting. (C.H.)

15769 (LAMS-3034(p.59-64)) EFFECTIVE RETENTION OF INTRAVENOUSLY ADMINISTERED BERYLLIUM^{7} BY RATS. C. R. Richmond, J. E. Furchner, and J. E. London (Los Alamos Scientific Lab., N. Mex.).

The retention of intravenously administered ^{7}Be in rats was followed by whole-body counting after administration as $^{7}BeCl_2$. (C.H.)

15770 (LAMS-3034(p.65-72)) THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON THE RETENTION OF STRONTIUM IN MICE. J. E. Furchner, C. R. Richmond, and G. A. Trafton (Los Alamos Scientific Lab., N. Mex.).

The effect of environmental temperature on the retention of ^{85}Sr in mice was studied by whole-body counting. Ambient temperatures of 5, 22, and 34°C altered the amount of ^{85}Sr lost, but no clear relation between Sr metabolism and environmental temperature was established. (C.H.)

15771 (LAMS-3034(p.73-5)) POTASSIUM^{40} AND CESIUM^{137} LEVELS OF BEAGLE HOUNDS. C. R. Richmond, J. E. Furchner, and J. E. London (Los Alamos Scientific Lab., N. Mex.).

The natural γ activity, due to ^{40}K and ^{137}Cs content, was determined for 20 beagle hounds prior to low-level tracer studies. The counting was done in a whole-body counter and data were processed by an IBM 7090 computer. Data are presented for each animal. (C.H.)

15772 (LAMS-3034(p.76-80)) VOLUME AND TURNOVER OF BODY WATER IN MALE MACACA MULATTA AND MACACA SPECIOSA MONKEYS. C. R. Richmond and J. E. London (Los Alamos Scientific Lab., N. Mex.).

Data are presented on the volume and turnover of body water in Macaca mulatta and M. speciosa monkeys as measured by the tritiated water dilution method. (C.H.)

15773 (LAMS-3034(p.96-102)) CELLULAR ELEMENTS IN THE PERIPHERAL BLOOD OF MACACA MULATTA AND MACACA SPECIOSA MONKEYS. C. R. Richmond and J. E. London (Los Alamos Scientific Lab., N. Mex.).

Several hematological parameters were measured for Macaca mulatta and M. speciosa monkeys. A reasonable similarity was found between the two species. (C.H.)

15774 (LAMS-3034(p.184-6)) RETENTION OF CESIUM^{137} BY ADULTS. M. A. Van Dilla and M. J. Fulwyler (Los Alamos Scientific Lab., N. Mex.).

An accident at the Lovelace Foundation in Oct. 1962 resulted in a ^{137}Cs inhalation exposure to several laboratory workers. Maximum body burdens of a few tenths of a μC were incurred. The retention of ^{137}Cs in these subjects was followed by measurements in Humco II and a human spectrometer. A biological half life of 140 days was found for ^{137}Cs in man. (C.H.)

15775 (LAMS-3034(p.187-200)) METABOLISM OF RADIOIODINE IN CHILDREN AND ADULTS USING SMALL (NANOCURIE) DOSES. M. A. Van Dilla and M. J. Fulwyler (Los Alamos Scientific Lab., N. Mex.).

A double tracer method using nanocurie doses of ^{125}I and ^{131}I was used to study iodine metabolism in children and adults. No differences due to age were observed. (C.H.)

15776 (LAMS-3034(p.288-95)) PREPARATION OF BACTERIAL DEOXYRIBONUCLEIC ACIDS. I. U. Boone and E. Campbell (Los Alamos Scientific Lab., N. Mex.).

Methods are described for the separation of high-molecular-weight desoxyribonucleic acid from several strains of bacteria. (C.H.)

15777 (LAMS-3034(p.296-302)) PURIFICATION AND CONCENTRATION OF T-4 BACTERIOPHAGE ON DEAE-CELLULOSE COLUMNS FOR DNA ISOLATION. I. U. Boone and E. Campbell (Los Alamos Scientific Lab., N. Mex.).

A method is described for the separation of desoxyribonucleic acid from bacteriophage using a cellulose ion exchange adsorbent column. (C.H.)

15778 (LAMS-3034(p.319-25)) APPLICATION OF AUTOMATIC COMPUTATIONAL TECHNIQUES TO THE ANALYSIS OF ULTRACENTRIFUGAL SEDIMENTATION-VELOCITY MOLECULAR WEIGHT DATA FOR DEOXYRIBONUCLEIC ACID. G. R. Shepherd, P. N. Dean, and B. J. Noland (Los Alamos Scientific Lab., N. Mex.).

A FORTRAN II program for the IBM 704/7090 computer was written for the analysis of ultracentrifugal sedimentation and velocity molecular weight data for desoxyribonucleic acid. (C.H.)

15779 (LAMS-3034(p.329-49)) OLIGONUCLEOTIDE SYNTHESIS. D. G. Ott, D. L. Williams, V. N. Kerr, G. T. Fritz, E. Hansbury, R. E. Hine, and F. N. Hayes (Los Alamos Scientific Lab., N. Mex.).

Reaction techniques applicable to oligonucleotide synthesis are discussed. The synthesis of compounds containing cytosine and thymine bases is described. (C.H.)

15780 (LAMS-3034(p.350-72)) CHROMATOGRAPHY OF NUCLEIC ACIDS. A. Murray, D. F. Petersen, T. T. Trujillo, and V. E. Mitchell (Los Alamos Scientific Lab., N. Mex.).

Data are summarized on the performance of selected resins for thin-layer chromatographic separation of nucleic acids. Data are included on applications in the separation of phosphorylated compounds of adenosine. (C.H.)

15781 (TID-7689(p.20-2)) COMPARATIVE STUDY OF THYROID AND WHOLE-BODY RETENTION OF IODINE IN BOX TURTLES. W. Gibbs, E. Wilson, H. Hodges, and C. C. Lushbaugh (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.).

A comparison of thyroid and whole-body retention of ^{131}I in the box turtle was made in order to test a whole-body counting method for measuring thyroid function in animal species where the size or location of the gland makes such measurement difficult or impossible with a collimated NaI crystal. A range of ^{131}I uptake within the hyperthyroid range for man and other animals was observed in the turtles. The large-volume specimen counter was found to be efficient and accurate and the results revealed that the accuracy of the whole-body counting method for determining thyroid function depends on the intra- versus extrathyroid bound iodide ratio. (M.C.G.)

15782 (TID-7689(p.22-5)) THYROIDAL AND EXTRA-THYROIDAL HORMONE METABOLISM IN CHILDREN. Leo Oliner (Veterans Administration Hospital, Bloomington, Ind. and Indiana Univ., Indianapolis. School of Medicine).

Using radioiodine kinetic data, the thyroidal secretion rate in children, ages 3 to 8, was found to average 14.2%/day compared to 3.8% for young adults. Daily hormonal degradation was found to be elevated on a per weight basis. It was concluded that the thyroid status in children consists of increased thyroidal secretion and increased thyroxin turnover. The relative thyroidal hyperactivity was self-limiting. (M.C.G.)

15783 (TID-7689(p.55-8)) THE BIOLOGICAL BEHAVIOR OF CESIUM^{137} IN RELATION TO THAT OF POTASSIUM. B. V. Rama Sastry (Vanderbilt Univ., Nashville. School of Medicine).

A study was undertaken to see if ^{137}Cs would behave like potassium under various physiological conditions. The similarities in the effects of acetazolamide and related compounds on the renal excretion of ^{137}Cs and K are summarized. The effects of various pharmacological agents on ^{137}Cs content in the muscle were determined. (M.C.G.)

15784 (TID-7689(p.58-62)) COMPLICATIONS IN RESIDUE STUDIES WITH RADIOISOTOPIC DRUGS. Charles Rosenblum, Dominick J. Tocco, and Eugene E. Howe (Merck Sharp and Dohme Research Labs., Rahway, N. J.).

Examples of possible erroneous conclusions from radioisotope studies of biological processes are illustrated with selected cases of tritiated and carbon-14-labeled materials. (M.C.G.)

15785 (TID-7689(p.68-9)) USING $C^{14}O_2$ FOR CARBON FIXATION STUDIES WITH POLLEN. James A. Goss (Kansas State Univ., Manhatten).

Studies of the fixation and metabolism of carbon dioxide by plant pollen using $^{14}CO_2$ are discussed. It was considered desirable that the pollen grain be allowed to germinate prior to exposure to $^{14}CO_2$. Small fritted glass discs were prepared and pollen spread over the surface. The disc fit a diffusion cell used for exposure. Labeled metabolites were identified by comparing the location of the label with the location of standards and by spraying the chromatograms with colored indicators. The technique gives qualitative, not quantitative, results. Attempts are being made to improve the sensitivity of the detection method and make it quantitative. (M.C.G.)

15786 (FTD-TT-63-559) PLUTONIUM-239: ITS DISTRIBUTION, BIOLOGICAL EFFECT AND ACCELERATED ELIMINATION. Translation from p.1-168 of "Plutonii-239: Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyevedeniya," Medgiz, Moscow, 1962. 277p.

The toxic effects of Pu^{239} in mammals are reviewed. An abstract was prepared on one section of this report. Other sections were abstracted previously and appeared in NSA Vol. 17 as abstracts 12,102 through 12,106; 30,250 through 30,252; 30,269 through 30,279; and 30,450. (C.H.)

For abstract of individual sections see: 15817.

15787 INFLUENCE OF CHLORDIAZEPOXIDE ON THYROID FIXATION OF RADIOIODINE (I^{131}). L. Caprino (Università, Perugia, Italy). Boll. Soc. Ital. Biol. Sper., 39: 671-3(July 15, 1963). (In Italian)

Experiments were carried out on lots of 15 adult male rats. The I^{131} was administered intraperitoneally (10 μC carrier-free NaI^{131} in 0.2 ml per animal) and fixation was determined 4 hr after administration. Chlordiazepoxide was administered intraperitoneally in doses of 5, 10, and 20 mg/kg 30 min before adminstration of I^{131}. Paper chromatography of thyroid homogenate (collidine : H_2O, 122 : 44, descending) separated I^{131} into inorganic I, monoiodotyrosine, diiodotyrosine, and thyroxine. Percentages of these stated as % of administered dose, respectively, are: controls, 10.4 ± 2.3, 41.3 ± 4.1, 30.8 ± 3, 11.75 ± 0.2; 5 mg/kg, 9.9 ± 2, 41.3 ± 1.07, 32.9 ± 3.3, 10.1 ± 0.8; 10 mg/kg, 10.1 ± 1.8, 38.9 ± 1.6, 33.8 ± 2.3, 8.82 ± 0.7; 20 mg/kg, 8.6 ± 1.5, 38.1 ± 2, 32.8 ± 3.17, 7.7 ± 0.1. It is concluded that chlordiazepoxide has a depressing effect on thyroid fixation of I^{131}, proportional to the administered dose. A dose of 5 mg/kg lowers fixation to 69% of the control; 10 mg/kg to 59.6%; 20 mg/kg to 44.6%. The drug also reduces the formation of thyroxine, with a correlation between dose and effect. The ratio of diiodo- to monoiodotyrosine also demonstrates an inhibition or retardation of the thyroid hormone formation by the drug, since it also decreases with increasing dose. (BBB)

15788 INFLUENCE OF CHLORDIAZEPOXIDE ON THE CAPACITY OF IODIDE CONCENTRATION AND ON THE SECRETORY ACTIVITY OF THE THYROID, STUDIED WITH I^{131}. L. Caprino (Università, Perugia, Italy). Boll. Soc. Ital. Biol. Sper., 39: 674-7(July 15, 1963). (In Italian)

Determination of thyroidal radioiodide concentration was performed on lots of 5 adult male rats. A 10-μC dose of carrier-free NaI^{131} was injected intraperitoneally 1 hr after administration of 20 mg propylthiouracil. One hr after administration of I the animals were sacrificed and the ratio of radioiodide per 100 mg thyroid to radioiodide per 0.1 ml plasma was determined. The drug was administered in doses of 10 and 20 mg/kg, 15 min after and 1 and 2 hr before the radioiodide. For the study of secretory activity of the thyroid, adult male mice were administered 10 μC of carrier-free NaI^{131}, and in vivo determinations were begun 48 hr later. Determinations were made regularly over a 48-hr period. Chlordiazepoxide was administered intraperitoneally in doses of 2.5, 5, and 10 mg/kg 50 to 52 hr after injection of radioiodide. Results were: chlordiazepoxide produces a reduction in the activity of thyroid iodine concentration in the rat, determinable from the ratio cited above; the reduction is significant only at 20 mg/kg, after the second hr after administration, the ratio dropping to about 80% of the control value. In the mouse, chlordiazepoxide brings about a depression of secretory activity of the thyroid at doses of 5 and 10 mg/kg, proportional to the dose; after 48 hr, activity was about 90 and 80% that of the controls, respectively. The drug thus appears to have an indirect effect, similar to the chlorpromazine and phenothiazine groups of drugs. (BBB)

15789 EFFECTS OF SEROTONIN ON THYROID CAPTURE OF I^{131} IN THE RAT. G. B. Salabe, A. Oliverio, P. Rossi, and F. De Luca (Università, Rome). Boll. Soc. Ital. Biol. Sper., 39: 969-70(Sept. 15, 1963). (In Italian)

Studies were carried out on 40 male albino rats to determine whether serotonin (5-hydroxytryptamine, 5-HT) had antithyroid activity. Ten animals served as controls; 10 were treated with serotonin; 10 drank ad libitum a suspension of 0.30 g methylthiouracil(MTU)/1000 ml H_2O; and 10 drank this suspension and were treated with serotonin. Serotonin was injected intramuscularly (1 mg per day per rat); after 7 days 1 μC carrier-free I^{131} was injected, and after 24 hr the animals were sacrificed. The thyroid was weighed and the radioactivity measured as percent of administered dose after comparison with a standard. Results were as follows for each group's wt, wt of thyroid (in g), and percent of dose: controls, 137 ± 7, 13.6 ± 0.6, 14.9 ± 0.8; treated with 5-HT, 135 ± 7, 13.4 ± 0.7, 14.8 ± 0.6; treated with MTU, 140 ± 10, 27.2 ± 0.5, 2.9 ± 0.6; treated with 5-HT + MTU, 130 ± 9, 26.5 ± 0.9, 2.7 ± 0.5. Thus no significant difference between the first and second group, nor between the third and fourth, was produced by serotonin. Zizine's results (Compt. Rend. Soc. Biol., 153: 1156(1959) are not in agreement with this and may be due to the short interval between administration and evaluation in his experiments. The diminution of thyroid capture noted by other authors may be explained by the arterial vasoconstrictor properties of serotonin. (BBB)

15790 THE METABOLISM OF VINCA ALKALOIDS. PART I. PREPARATION OF TRITIATED VINBLASTINE; THE RATE OF URINARY EXCRETION OF RADIOACTIVITY BY RATS RECEIVING THE COMPOUND. C. T. Beer, M. L. Wilson, and J. Bell (Univ. of British Columbia, Vancouver). Can. J. Physiol. Pharmacol., 42: 1-11(Jan. 1964).

The preparation of tritium-labeled vinblastine by the Wilzbach irradiation method is described. Tritiated dihydrovinblastine was concurrently formed and could not be detected or separated from tritiated vinblastine by previously available methods. It is now found that tritiated vinblastine can be freed from the contaminating dihydro compound by chromatography on cellulose phosphate. The rate of urinary excretion of radioactivity by rats given injections of the purified alkaloid was studied. About 5% of the dose radioactivity is excreted in the urine collected in the 12-hr period after injection; thereafter only very minor amounts of radioactivity are eliminated by this route. (auth)

15791 SLOW ABSORPTION CURVES OF ^{131}I FROM THE GASTROINTESTINAL TRACT. Peter L. Eberstadt and Amparo Corachán. Com. Nucl. Energia Nucl. (Mex.), [Publ.], No. 134, 1-14(Dec. 1963). (In English and Spanish)

From among patients sent for routine studies of thyroid uptake of ^{131}I, 48 were selected at random for the purpose of studying the disappearance curves of ^{131}I from the digestive tract. This was carried out by placing a wide-collimated scintillation tube at a point 20 cm. in front of the navel and recording continuously for a period of 90 min from the time of administration of the iodine per os. The disappearance curves for ^{131}I from the abdomen were variable. In one case, after 90 min, only 9.5% of the maximum reading still remained. Twelve curves, or 25% of the total, showed very slow disappearance, at least 59% of the maximum reading remaining after 90 min, and in one case as much as 91%. It may thus be affirmed that in these patients absorption was very slow. It may be concluded that all cases of slow absorption either were not producing thyroid hormones or were unable to direct them into the blood stream. (auth)

15792 RESPONSE IN RAT INCISOR DENTIN TO INJECTED STRONTIUM, FLUORIDE, AND PARATHYROID EXTRACT. James A. Yaeger and Dale R. Eisenmann (Univ. of Illinois, Chicago). J. Dental Res., 42: 1208-16 (Sept.-Oct. 1963).

Rat incisor dentin was examined by microradiography after subcutaneous injection of 1 to 8 mg NaF/100 g body wt, 2 to 125 mg $SrCl_2$/100 g, or 50 to 800 U.S.P. units parathyroid extract (PTE)/100 g. With NaF, some alteration in mineralization was domonstrable in every incisor examined; even at a dose of 1 mg/100 g, a distinct hypermineralized layer of dentin was present. At 2 mg/100 g, the hypermineralized layer was wider, and a slightly hypomineralized layer could be detected. The lowest dose of $SrCl_2$ (2 mg/100 g) produced no response, but at 5 mg/100 g a hypomineralized layer was detectable and a 20 mg/100 g and higher the hypomineralized layer was distinct in all areas examined. Its thickness was frequently greater than that of the hypomineralized component produced by NaF, and the Sr-hypomineralized layer was usually more radiolucent. No distinct hypermineralized component was found. In animals injected with PTE, no response was found with doses of 100 units/100 g and lower, but at higher doses a hypomineralized layer was clearly defined, continuous, and wider than the hypomineralized component produced by F. As in the Sr series, no hypermineralized component was found. These findings are contrary to the conclusions reached from examination of hematoxylin-stained sections, where the responses in dentin produced by NaF, $SrCl_2$, and PTE appeared identical. When examined in microradiographs, the Sr and PTE responses contained a hypomineralized component but no hypermineralized component, while the F response included both. The hypomineralized components in the Sr and PTE responses were wider than that of the F response. These differences suggest that the etiology of the response is different for each of these causative agents. (BBB)

15793 A STUDY OF THE STABILITY OF CHROMIUM-51 LABELED SERUM ALBUMIN. Leopoldo José Anghileri (Volk Radiochemical Co., Skokie, Ill.). J. Nucl. Med., 5: 216-17(Mar. 1964).

The stability of Cr^{51}-labeled serum albumin was studied making use of both chromatographic and dialysis analytical procedures. This Cr^{51}-labeled compound is now being used as an indicator of loss of protein into the gastrointestinal tract. The good stability of Cr^{51}-labeled serum albumin under the conditions of the experiment was demonstrated. (C.H.)

15794 SOME INDEPENDENT AND COMBINED EFFECTS OF COPPER, MOLYBDENUM, AND ZINC ON THE PLACENTAL TRANSFER OF ZINC-65 IN THE RAT. Kenneth E. Kinnamon (U. S. Army Medical Research and Nutrition Lab., Denver). J. Nutr., 81: 312-20(Dec. 1963).

Metabolism of Zn has assumed greater importance since the advent of the nuclear age, and since the start of atomic weapons testing, Zn^{65} has been reported in farm products, mollusks, fish, cattle, and in the Marshall Island natives, as well as in cyclotron workers. Radiozinc has been also found to be second only to radiophosphorus as an ecologically troublesome isotope in the vicinity of reactor sites. Hence an investigation was undertaken to observe how increased dietary levels of different combinations of three elements, Cu, Mo, and Zn, affect growth and the excretion and placental transfer of intraperitoneally injected radiozinc in rats. Addition of 0.01% Cu and/or 0.08% Mo to the diet of pregnant rats causes competition with Zn within the fetus and placental structures (amnion, chlorion, yolk sac,

allantois, and decidua) resulting in a lower uptake of Zn^{65} in these tissues. A high level of dietary Mo counteracts the influence of an increased level of dietary Cu on this uptake in the absence of increased dietary Zn, and partially overcome the influence of excess Cu when it is fed in combination with a high level of Zn (0.50%). Molybdenum apparently does not elicit a similar action on dietary Zn. Autoradiographic studies were conducted in calcifying bones; liver, spleen, and lumen of large blood vessels; and kidneys. A highly significant increase in Zn^{65} urine excretion was observed in rats fed a ration high in Zn, and a significant increase was noted in animals fed an excess Cu and Mo diet. Possible competitive mechanisms are discussed. (BBB)

15795 KINETICS OF STEROID EFFECTS OF Ca^{47} DYNAMICS IN DOGS WITH THE ANALOG COMPUTER. [PART] I. Edward R. Garrett (Univ. of Florida, Gainesville), Richard L. Johnston, and Elliott J. Collins. J. Pharm. Sci., 51: 1050-7(Nov. 1962).

A detailed quantitative analysis is presented of the effects of adrenal steroids on the distribution and kinetics of intravenously administered Ca^{47} in dogs. The digital- and analog-computer techniques described herein facilitated quantifications of the massive data. The initial disappearance curves of radiocalcium from the blood were also determined. Four polyexponentials were used to describe the Ca^{47} content of blood as a function of time after intravenous administration. Quantitative measures of determining Ca^{47} incorporation into the deep compartment that may be synonymous with bone are described. The exponential constants for the distribution and elimination of Ca^{47} for all dogs and under all conditions studied (control, steroid, and recovery periods) were similar. The short half life of Ca^{47} of 4.56 days permitted sequence studies of Ca dynamics from the distribution and excretion of Ca^{47}. The most pronounced effect of steroid (6 α-methylprednisolone) treatment in dogs was the increased amount of Ca^{47} accumulated in the feces. A similar effect was observed with Ca^{47} accumulated in the urine although the percentage of the total administered dose excreted in the urine (2 to 6%) was much less than that excreted in the feces (20 to 60%). A possible, but less well-defined effect of steroid treatment was the decrease in apparent blood volume from the control period as based on measurement of Ca^{47} in blood. The rate of Ca^{47} return from the deep compartment was accelerated by steroid therapy. It may be that bone accretion is inhibited and bone resorption accelerated by steroid therapy, inducing the reversible osteoporosis seen by Cushing's syndrome. A rebound effect was also noted in that, on cessation of steroid therapy, the dog utilizes more Ca^{47} and the rate of return from the deep compartment is lessened. The possible utilization of more effective osteoporotic agents as measured by these techniques is of interest in the removal of bone-seeking radioisotopes produced by fallout contamination. (BBB)

15796 RATIOS OF STRONTIUM-90 TO CALCIUM IN MILK AND IN THE BONES OF INFANTS. J. F. Loutit (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.), R. Scott Russell, R. S. Bruce, and B. O. Bartlett. Nature, 201: 770-2(Feb. 22, 1964).

Results of an extensive survey in the United Kingdom of the milk Sr^{90} content are considered to provide an improved basis for establishing an empirical relationship (the bone/milk factor) between the ratio of Sr^{90} and Ca in milk and that in the bones of infants. Bones of more than 500 infants who died between the ages of one week and one year were analyzed. Each bone measurement was related to the milk from the appropriate zone in the country-wide milk survey. The bone/milk factor was found to significantly increase between ages of 1 and 5 months, but no significant changes were noted between the age of six months and one year. Consideration was given to the extent to which variation in the bone/milk factor between years may be attributable to dietary factors. It was concluded that the average ratio of Sr^{90} to Ca in bones of infants in the first year of life is about one-fourth that in milk. (H.M.G.)

15797 EFFECT OF AN ERYTHROPOIETIN PREPARATION ON UPTAKE OF IRON-59 BY TIBIAE OF NEWBORN RATS. S. Fischer and G. J. Fruhman (Albert Einstein Coll. of Medicine, New York). Nature, 201: 836-8(Feb. 22, 1964).

The ability of whole bones to incorporate radioiron in vitro was assessed. Tibiae were removed from one, two, and fifteen-day-old Sprague-Dawley rats and placed in incubation flasks to which were added erythropoietin (ESF) preparations. Activity of the ESF preparation was determined by measuring Fe^{59} uptake and clearance in starved rats. Although no differences were seen between experimental and control samples in the early hours of incubation, heightened Fe^{59} uptake was evidenced in the ESF flasks at 24 hr, and at 48 hr the increased Fe^{59} uptake by experimental samples was striking. Iron-59 uptake in the presence of erythropoietin was greater in newborn than 15-day-old rats. (H.M.G.)

15798 EFFECT OF LIGHT AND RELATED FACTORS ON ION ABSORPTION BY BANANA LEAF DISKS. P. B. Vose and S. C. Shim (Seoul National Univ., Korea). Nature, 201: 1047-8(Mar. 7, 1964).

An investigation was made on the effects of light on the uptake of Sr either separately or with calcium and potassium by banana leaf disks. Dark treatment was commenced at the start of the uptake period. It was found that uptake was in all cases greater in the light than in the dark, there being the least difference with Sr alone. The competitive effect of Ca and K was much greater in the dark than in the light, and there was no significant difference between K and Ca as the competitive ion. A further experiment was concerned with light and dark pretreatments in relation to nitrogen and carbohydrate-level. Disks were vacuum infiltrated with either water, nitrate, sucrose, or sucrose and nitrate together and were incubated in 500 ml of aerated solution both in the light and the dark for 88 hr at 22°C. The results showed that uptake of both Sr and P is greater by disks pretreated in the dark. Pretreatment, markedly with sucrose, altered both dry weight and nitrogen content. The results suggest two distinct major features affecting ion absorption by leaf cells. First there appears to be a short-term light effect per se, and secondly there is an indirect effect of light through its influence on carbohydrate and nitrogen assimilation. (P.C.H.)

15799 THE MEASUREMENT OF GASTRO-INTESTINAL ABSORPTION OF Co^{58}-LABELLED VITAMIN B_{12} BY WHOLE BODY COUNTING. E. H. Belcher, Barbara B. Anderson, and C. J. Robinson (Postgraduate Medical School, London). Nucl. Med., 3: 349-55(1963).

A method for the measurement of gastrointestinal absorption of Co^{58}-labeled vitamin B_{12} by whole-body counting is described. Subjects receiving doses of 1 μg of vitamin containing 0.5 to 1 μC of Co^{58} are measured by means of a single scintillation counter detector installed in a low background enclosure, using a standard chair technique. Measurements on 40 patients studied both by the fecal recovery method and by the whole-body counting method show

that the latter provides a simple and reliable test of vitamin B_{12} absorption avoiding the inconvenience and uncertainty of collection of feces or urine. (auth)

15800 THE PATHOLOGIC ANATOMY OF DEUTERIUM INTOXICATION. Paul Bachner, Donald G. McKay, and David Rittenberg (Columbia Univ., New York). Proc. Natl. Acad. Sci. U. S., 51: 464-71(Apr. 1964).

Results are presented of investigations into the nature of the anatomic changes produced upon replacement of one-third or more of the total body water of a mouse with heavy water. Microscopic findings included focal renal tubular necrosis, profound alterations in testicular architecture and cellular morphology, and abnormalities of the excretory ducts of the salivary glands. 22 references. (R.E.U.)

15801 THE EFFECT OF RUBIDIUM-86 DIFFUSION ON THE UPTAKE OF RUBIDIUM-86 BY CORN. S. D. Evans and S. A. Barber (Purdue Univ., Lafayette, Ind.). Soil Sci. Am. Proc., 28: 56-7(Jan.-Feb. 1964).

Uptake of ^{86}Rb by corn roots was highly correlated with the diffusion of Rb in soil and kaolinite systems. At values of Dp/b above 1×10^{-6} cm^2/sec the relation was curvilinear whereas it was more nearly linear at rates less than this. The curvilinear relation at the higher rates of diffusion was attributed to the limitations of the rate of absorption of the root. (auth)

15802 LIMITATIONS IN THE USE OF CARBON-LABELED AND TRITIUM-LABELED THYMIDINE IN CELL CULTURE STUDIES. Robert B. Painter, Ruth M. Drew, and Ronald E. Rasmussen (Ames Research Center, Moffett Field, Calif. and Brookhaven National Lab., Upton, N. Y.). Radiation Res., 21: 355-66(Mar. 1964).

Experiments were performed with C^{14}-thymidine or unlabeled thymidine added to HeLa S3 cell cultures growing in Eagle's medium. The results show that thymidine in the culture medium causes a concentration-dependent inhibition of growth, with effects being significant at levels as low as 10 μg/ml, thymidine in the medium reduces the incorporation of H^3-uridine into both DNA and RNA, the effect on incorporation into RNA being unexpectedly great, and other nucleosides, added singly or together to the medium, cause effects similar to those induced by thymidine. Thirty-minute incubations with tritiated thymidine, at concentrations from 0.02 to 2.5 μC/ml, and at two specific activities, did not affect the production of colonies of HeLa S3 cultures. (auth)

15803 COMPARATIVE METABOLISM OF BARIUM-133 AND CALCIUM-45 BY EMBRYONIC BONE GROWN IN VITRO. Wellington Moore, Jr. (Public Health Service, Montgomery, Ala.). Radiation Res., 21: 376-82(Mar. 1964).

The comparative metabolism of ^{133}Ba and ^{45}Ca by embryonic chick bone grown in vitro is reported. The uptake of ^{133}Ba was influenced by the period of incubation in the labeled medium, size of bones, and concentrations of Ca and Ba ions in the medium. Culturing of embryonic bone in vitro showed that chick and rat bone could discriminate against ^{133}Ba in favor of ^{45}Ca. Treating the bones with formalin destroyed their ability to discriminate against ^{133}Ba. In live bones, the selective mechanism functioned at 37°C but not at 3°C. The results suggested that discrimination against Ba in favor of Ca was largely a function of viable bone cells. (auth)

15804 IN VIVO TRANSFER OF RADIOSELENIUM, Se^{75}, ACROSS THE PERICARDIUM OF DOGS. Gary Colonna, George E. Burch, John J. Walsh, and Thomas D. Darby (Tulane Medical School, New Orleans). Texas Rept. Biol. Med., 21: 331-6(1963).

The time course of change in concentration of Se^{75} after introduction into the pericardial fluid in dogs is presented. Serial studies of whole blood, plasma, and erythrocytes indicated that the isotope was detectable in the blood 30 min after the beginning of the experiment and that a low level of radioactivity persisted throughout the observation period in plasma and erythrocytes. Urine was found to contain a trace of Se^{75}. The isotope was rapidly removed from pericardial fluid in the 4-hr observation period. Previous investigations of the kinetics of transfer of Mg^{28}, Cd^{115m}, Rb^{86}, K^{39}, Na^{24}, Na^{23}, Cl^{36}, and Cl^{35} across the pericardium of the dog are discussed. (BBB)

15805 COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY. VOLUME XXVIII. SYNTHESIS AND STRUCTURE OF MACROMOLECULES. Cold Spring Harbor, N. Y., Cold Spring Harbor Laboratory of Quantitative Biology, 1963. 630p.

Significant advances were reported in studies on the synthesis and structure of macromolecules. Topics discussed included the synthesis and structure of DNA and RNA; transfer RNA; protein synthesis; the regulation of synthesis of macromolecules; the tertiary structure of proteins; allosteric interactions between proteins and small molecule; evidence from amino acid substitutions and in vitro systems for amino acid codes; and mechanisms of complementation. (C.H.)

15806 PULMONARY DEPOSITION AND RETENTION OF INHALED AEROSOLS. Monograph Series on Industrial Hygiene. Theodore F. Hatch (Pittsburgh. Univ. Graduate School of Public Health) and Paul Gross (Mellon Inst., Pittsburgh). 1964. 203p. $5.75.

Health hazards from particulate air pollution are reviewed. It is pointed out that a countless number of gaseous contaminants of the atmosphere produce clear-cut and unique symptoms of poisoning such as those caused by carbon monoxide, benzene, and carbon tetrachloride. Particulate allergens, bacteria, viruses, insecticide mists, metallic fumes, and organic and mineral dusts are also dispersed in the atmosphere and produce toxic effects when they enter the body through the respiratory tract. Radioactive particles can produce significant internal doses of radiation that may act on lung tissue or in other parts of the body after transport from the lungs. Emphasis is placed on intermediate factors that operate between the contaminated atmosphere and the internal tissue damage or disease caused by the gas or dust. These factors include site of deposition of a dust or absorption of a gas; particle size, shape, and density; air-flow pattern; clearance mechanisms; and site of injury in the body. (237 references.)(C.H.)

Radiation Effects

Refer also to abstract 16259.

15807 (LAMS-3034(p.112-15)) ACUTE RADIOSENSITIVITY AS A FUNCTION OF AGE IN MICE. J. F. Spalding, O. S. Johnson, and R. F. Archuleta (Los Alamos Scientific Lab., N. Mex.).

The radiosensitivity of mice as a function of age following exposure to single doses of x radiation was determined using the $LD_{30/50}$ approach. Variability in radiosensitivity was shown to increase with age. (C.H.)

15808 (LAMS-3034(p.116-23)) COLD STRESS AS A TEST FOR RATE OF AGING IN THREE LINES OF MICE WITH DIFFERENT HISTORIES OF ANCESTRAL X-RAY EXPOSURE. J. F. Spalding and T. T. Trujillo (Los Alamos Scientific Lab., N. Mex.).

The rate of aging after exposure to cold stress was compared for three lines of mice with different histories of ancestral x-ray exposure. The three lines of mice studied showed a considerable amount of variability of response to cold stress at ages of 1 to 12 months. (C.H.)

15809 (LAMS-3034(p.124-8)) BREEDING CHARACTERISTICS OF OFFSPRING FROM MICE WITH FIFTEEN GENERATIONS OF X IRRADIATION TO THE MALES. J. F. Spalding and M. R. Brooks (Los Alamos Scientific Lab., N. Mex.).

Data are presented on the breeding characteristics of offspring from mice with 15 generations of x-irradiated males and the nonspecific genetic effects of x radiation as observed in this population. (C.H.)

15810 (LAMS-3034(p.129-32)) RADIATION-INDUCED IRREPARABLE BIOLOGICAL DAMAGE IN THREE GENETIC LINES OF MICE WITH DIFFERENT ANCESTRAL HISTORIES OF RADIATION EXPOSURE. E. F. Spalding and R. F. Archuleta (Los Alamos Scientific Lab., N. Mex.).

The ability to tolerate cold stress following γ irradiation was considerably reduced in mice from three strains with a history of ancestral irradiation extending over several generations when compared with mice from an unirradiated strain. Possible genetic factors responsible for the difference in radiosensitivity are discussed. (C.H.)

15811 (LAMS-3034(p.133-40)) INABILITY OF THE MOUSE TO RECOGNIZE GAMMA RADIATIONS. I. VARIABLE LOW DOSE RATE STUDIES IN RF MICE. J. C. Hensley, J. F. Spalding, W. F. Schweitzer, and R. F. Archuleta (Los Alamos Scientific Lab., N. Mex.).

Low-dose-rate γ radiations, regardless of accumulated dose totals, did not evoke a recognition response in mice. Individual $AgPO_3$ glass rods implanted in the abdomen of the mice were used to measure γ doses ranging from 10 to 10^5 r from a 3-C ^{60}Co source. The average accumulated dose received by the implanted dosimeters was 2.628×10^3 rods. (C.H.)

15812 (LAMS-3034(p.303-6)) CHROMOSOME OBSERVATIONS IN NONIRRADIATED PROGENY FROM SEVERAL LINES OF IRRADIATED RF MALES. I. U. Boone, P. M. LaBauve, and J. F. Spalding (Los Alamos Scientific Lab., N. Mex.).

No striking differences were noted in the morphology, modal number, or karyotype of chromosomes in the bone marrow of the progeny from several lines of irradiated male mice. (C.H.)

15813 (NP-13733) MODIFICATIONS APPORTEES PAR L'IRRADIATION X AUX LIPIDES ET A QUELQUES AUTRES CONSTITUANTS DU FOIE DE COBAYE (THÈSE). (Modifications to Lipids and Some Other Constituents of the Liver of the Guinea Pig Caused by X Radiation (thesis)). Odette Gallien (Paris. Université). 1959. 131p.

The effect of whole-body and local x radiation on the lipids, proteins, and glycogen of the liver of guinea pigs was systematically studied on males aged 5 to 7 months. The experimental techniques and the analytical methods used were described. The control guinea pigs were fed exactly the same diet in quality and quantity as the irradiated animals. The composition of the normal and fasting guinea pig was determined before the irradiation studies. Whole-body irradiation with a lethal dose in a single dose or over a period of several weeks led to the appearance of an enlarged liver. Biochemical analysis showed that the glyceride overcharge is moderated, the glycogen modifications were concomitant with those of lipids, and the total quantity of proteins increased. Irradiation of the head with a sublethal dose did not affect the composition of the liver. Lethal doses caused an intense glyceride-enlarged liver. Three to six months after local irradiation on the hepatic region or after single-dose or fractionated whole-body irradiation, late steatosis appeared and seemed to be the only direct effect of x radiation on the hepatic cells. The acute hepatic modifications had an external origin. The most toxic form of irradiation was whole-body irradiation in fractionated doses. (J.S.R.)

15814 (USNRDL-TR-698) THE BIOELECTRICAL RESPONSE OF THE INSECT EYE TO BETA RADIATION. J. C. Smith and D. J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). Nov. 29, 1963. 30p. (AD-429190)

Moths of the family Noctuidae were used to determine the bioelectric responses of the compound eye to ionizing radiation. It was found that β radiation can induce a bioelectric reaction in the compound eye of the insect. The electroretinographic pattern is indistinguishable from that produced in response to a light stimulus. The flicker-fusion frequency threshold is also similar for the two stimuli. However, a difference exists between light and β radiation in the time course of the dark adaptation process. It could be demonstrated that the disparity is dependent upon the interaction of visual pigment with the light stimulus. An electroretinogram response was elicited by a β dose of less than one milliroentgen at the radiation dose rate of 20 mr/second. (auth)

15815 (USNRDL-TR-712) THE EFFECT OF AGE AT EXPOSURE ON RADIATION-INDUCED POLYDIPSIA IN THE RAT. G. K. Osborn, D. C. Jones, and D. J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). Jan. 8, 1964. 24p. (AD-430641)

The effect of age at exposure to a single, sublethal dose of fast neutrons upon acute postirradiation changes in water and food consumption and on body weight was studied in young (101 days) and old (619 days) rats. Food consumption (anorexia) and body weight (loss) responses were similar for the two groups in time (days 1-4 postirradiation) and degree of occurrence. The typical biphasic polydipsia that is observed during the first five days after irradiation of young adult rats was not found in the older animals. Rather, the old rats showed a depressed water consumption with respect to both their own pre-irradiation level of their nonirradiated controls, from the fourth to the eighth days. This depression did not appear to be related to a state of morbidity. (auth)

15816 (CEA-tr-R-1635) ETUDE DE LA COMPOSITION CHIMIQUE DU CRISTALLIN DE L'OEIL LORS D'UNE CATARACTE DUE AUX RAYONNEMENTS. (Study of the Chemical Composition of Eye Lens at the Time of Radiation Cataracts). L. M. Lusanova and A. A. Tshubakov. Translated into French from Med. Radiol., 6: No. 9, 21-6(1961). 10p.

Cataracts were induced on the eyes of rabbits by irradiation to 1000 r, and the elemental concentration in the lenses with cataracts was determined by activation analysis and was compared with those of normal lenses and lenses with natural cataracts. The composition of the vitreous humor of healthy and irradiated eyes was also compared. Cataract formation apparently occurs simultaneously with the observed change in composition. The results also support previous evidence that Na^{24} uptake by irradiated lenses increases, while K^{42} uptake decreases. (D.C.W.)

15817 (FTD-TT-63-559(p.150-72)) PECULIARITIES IN THE COURSE AND OUTCOME OF RADIATION SICK-

NESS IN DOGS INJECTED INTRAVENOUSLY WITH THE NITRATE OF PLUTONIUM-239. L. V. Bogatov, Z. I. Kalmykova, N. P. Kudasheva, and S. A. Rogacheva.

The effects of 0.05 μC/kg of Pu^{239} administered intravenously to dogs once a month up to a total dose of 0.2 μC/kg were followed for 4.5 yr. Moderate changes in the nervous, cardiovascular, digestive, and hematopoietic systems were observed during the first year. The functioning of all systems returned to normal during the 2nd to 4th years except for the persistent impairment of hematopoiesis. Osteosarcomas developed in 75% of the animals. The average latent period for bone tumor formation was 3 yr and 10 months. (C.H.)

15818 (JPRS-23544) MORPHOLOGICAL CHANGES IN THE CAT BRAIN FOLLOWING CLOSED CRANIOCEREBRAL INJURY ASSOCIATED WITH RADIATION SICKNESS. V. G. D'yachkov. Translated from Vopr. Neirokhir., 27: No. 6, 6-11(1963). 7p. (OTS-64-21724)

Healthy mature cats were divided into four groups: the first series included closed injuries of the skull and brain; the second series acute radiation sickness; the third series combined effects of radiation sickness and craniocerebral injury; and the fourth series served as a common control. Craniocerebral injury was inflicted in unanesthetized animals in the right frontoparietal region by means of a 1-kg weight falling from a height of 2 m. Acute radiation sickness was induced by a single 350-r x-ray exposure. The animals were killed one to 45 days after injury. Dissection studies were directed to the condition of the internal organs, and histological examinations were made of the brain frontal sections. It was found that phasic development inherent in radiation sickness was retained in the combined situation; but the course of the injury became more severe, and its development was greatly accelerated. (H.M.G.)

15819 (UCRL-Trans-1029) CONDITIONS FOR REACTIVATING YEAST ORGANISMS AFTER RADIATION INJURY. T. S. Remezova and V. P. Tret'yakova. Translated by M. Kassatkin (Univ. of California, Lawrence Radiation Lab., Livermore), from Zh. Obshch. Biol., 22: 120-7(1961). 15p.

In order to study the role of endogenous respiration in the reactivation process, experiments were conducted on a respiration-deficient mutant of Saccharomyces vini. It was established that the cytoplasmic mutant of the initial organism with a reduced cytochrome system does not restore radiation injuries. The cells of the mutant which preserved cell division after their irradiation die rapidly with incubated in water. Thus, the data obtained confirmed the observations of Korogodin (1958) and showed that Saccharomyces vini, strain Megri 139B, being, to a considerable extent, an auxoautotrophic organism with a stable endogenous respiration, actively reactivated after radiation injuries under the conditions of slowed down metabolism when incubated in water after irradiation. At the same time, a respiration-deficient mutant of the same organism was completely incapable of restoring its cell division function, even when exposed to such low radiation doses as 10, 15, and 25 kilorad. It is concluded that the process of reactivation of radiation injuries in yeast organisms is connected with energy metabolism in the cells. However, since different species of microorganisms require different additional factors of nutrition, it is not possible to expect all of them to be capable of restoring radiation injuries in water. (auth)

15820 DEVELOPMENT OF HEMAGGLUTINATION-INHIBITING ANTIBODIES IN WHITE RATS IMMUNIZED AGAINST INFLUENZA VIRUS AND SUBJECTED TO THE ACTION OF RADIATION EMITTED BY I^{131} AND P^{32}. O. Burducea, M. Cepleanu, and R. Capraru (Institutul de Inframicrobiologie al Academiei R.P.R., Bucharest). Acad. Rep. Populare Romine, Studii Cercetari Inframicrobiol., 12: 137-42(1961). (In Rumanian)

The investigation was conducted to study the effect of ionizing radiations on production of hemagglutination-inhibiting antibodies in rats immunized against influenza. The following substances were injected intraperitoneally: NaI^{131} solution with a specific activity of 1.774 mC/ml and a concentration of 0.1 mg/ml; I^{131} with a specific activity of 3.9 mC/ml dissolved in a solution of Na thiosulfate; and $Na_2HP^{32}O_4$ solution with a specific activity of 2.08 mC/ml and a concentration of 8.3 mg/ml. The solutions were diluted to obtain an activity of 50 μC/ml, and 0.5 ml of I^{131} or P^{32} solution with a total activity of 25 μC was injected. Control groups of animals received an intraperitoneal injection 0.5 ml of a solution of stable I or the same amount of stable P. All rats had been previously inoculated intraperitoneally with 0.5 ml of undiluted allantoic fluid containing the virus (hemagglutination titer 1/5120). Anti-influenza hemagglutination-inhibition antibodies were determined at intervals of 4, 8, 12, and 20 days following the administration of radioactive I and P. Results showed that I^{131} had a marked effect on the antibody titer, resulting in a considerable decrease. In contrast, animals receiving P^{32} or injections of stable I or P showed no appreciable difference in titers from the controls. Neither the ultimate titer nor the appearance of anti-influenza antibodies were affected by these substances. (BBB)

15821 I^{131} AND THE FREEDMAN REACTION. F. Salamanca De La Pena and P. De La Pena Regidor (Instituto de Patologia Regional, Tenerife, Canary Islands). Acta Med. Tenerife, 17: 103-4(1962). (In Spanish)

It was shown previously that 800 mC of I^{131} injected into the reproductive organs (ovary and uterus) of adult female rabbits produces severe lesions in the Graafian follicles (destroying their anatomical structure), in the epithelium of the granulosa, cumulus ovaricus, and especially in the ovum. In the uterus, decidual or progestational transformations do not take place. When these animals were mated with normal male rabbits they were unable to reproduce. With this as a background, the response of these damaged ovaries to stimulation by chorionic gonadotropin (Freedman reaction) was investigated. Adult female rabbits received a parenteral injection of 800 mC I^{131} and 10 days later an intravenous injection of 300 U chorionic gonadotropin; 48 hr later they were sacrificed. In spite of considerable damage to the Graafian follicle and cytoplasm and nucleus of the ovum, the follicles continued to respond to chorionic gonadotropin hormone in the typical way. But reproduction was imparied owing to lesions of the mature follicles in pregnant rabbits injected with I^{131}; abortion occurred, apparently on account of injury to the decidua. (BBB)

15822 MORPHOLOGICAL CHANGES IN THE SPLEEN AFTER NITROGEN MUSTARD POISONING AND X-RAY IRRADIATION. D. Tanka, B. Fiam, and G. David (National Inst. of Rheumatology and Balneology, Budapest). Acta Morphol. Acad. Sci. Hung., Suppl. 10: 66(1962).

Rats were subjected to x irradiation with 800 r, equaling the $DL_{50/30}$, and their spleens were tested by histochemical methods for cytochrome oxidase, succinic dehydrogenase, nonspecific esterase, and alkaline and acid phosphatase activity. The radiation effect was compared with that of an equivalent dose of nitrogen mustard. Cytochrome oxidase

and succinic dehydrogenase activity showed no noteworthy changes; 24 and 48 hr after irradiation, the localization of alkaline phosphatase activity was sparse, in just a few cells around the follicle centers. After 120 hr the capillaries were the only components to give a positive reaction. After 240 hr the activity began to reappear and the localization of enzyme activity became normal. Nitrogen mustard caused a marked decrease of alkaline phosphatase activity and two days after irradiation the enzyme activity was low. Acid phosphatase activity rose in response to irradiation for 48 hr and subsequently decreased. Nitrogen mustard caused a considerable reduction of acid phosphatase activity in the first 48 hr, but restitution was complete after 120 hr. Nonspecific esterase activity responded to both treatments with the same rise of intensity, to diminish to the control level after 240 hr. These results furnish evidence that ionizing radiation as well as nitrogen mustard may produce either a drop or a rise in enzyme activity. The difference between the two effects is that the response provoked by radiation develops at a slower rate and under certain conditions lasts much longer than that of nitrogen mustard, which becomes effective soon after exposure and shows a shorter period before normalization. (BBB)

15823 SEX RATIO SHIFTS AMONG PROGENY FROM PATIENTS HAVING RECEIVED THERAPEUTIC X-RADIATION. P. J. L. Scholte and F. H. Sobels (Municipal Hospital Zuidwal, The Hague and Univ. of Leiden). Am. J. Human Genetics, 16: 26-37(Mar. 1964).

Data were collected on changes in the sex ratio, expressed as percentage of males in the progeny, after therapeutic irradiation in various Dutch hospitals. Following maternal irradiation with 70 to 270 rads, the sex ratio decreased from 54.1% (242 births) before irradiation to 48.5% (230 births) after irradiation. The shift is not significant, but the data show no heterogeneity with those obtained by Turpin, Lejeune and Rethore (1960) in France. For the combined sets of data, the decrease of the sex ratio after exposure to radiation of women is significant ($P = 0.023$). Since any of the well known factors influencing sex ratio, such as birth order, paternal age, and annular fluctuations, including war, cannot account for the observed decrease in sex ratio, it is concluded that it was caused by radio-induced genetic changes. Following paternal irradiation (25 to 370 rads), the sex ratio increased significantly ($P = 0.035$) from 47.0% (1258 births) before irradiation to 52.5% (932 births) after irradiation. Here, however, the sex ratio before irradiation was abnormally low and differed significantly from the population average. An analysis of the material showed this trend among patients with totally different clinical conditions, but all had in common the fact that after radiotherapy the frequency of male births increased. Following paternal exposures to low doses of 1 to 10 rads, no change in the sex ratio was observed, in contrast to results obtained by Turpin, Lejeune and Rethore (1960). (auth)

15824 IMMUNOGENICITY OF GAMMA-IRRADIATED MYCOBACTERIUM TUBERCULOSIS H37Rv (GIV) IN MICE. H. Nishihara, C. A. Lawrence, G. V. Taplin, and C. M. Carpenter (Univ. of California, Los Angeles). Am. Rev. Respirat. Diseases, 88: 827-32(Dec. 1963).

Results of experiments on a γ-irradiated vaccine (GIV) are reported. Cells irradiated with 500,000 or 1,000,000 r were injected subcutaneously in mice. The tests for reproductive viability by culture and guinea pig inoculations indicated that 500,000 r was sufficient to inactivate the tubercle bacilli. No visible growth was observed in culture media inoculated with cells exposed to 500,000 or 1,000,000 r, and organs of guinea pigs injected with these cells showed no gross signs of infection. A long-term vaccination study showed that the vaccinated mice became segregated into two nonoverlapping groups. One group consisted of animals which developed little or no immunity and died after challenge within the period of time during which all of the nonvaccinated controls died (15 to 28 days); in the other group, the mice developed sufficient immunity to live 2 to 6 times longer (55 to 191 days). In terms of survival rates on day 35 after challenge, vaccination with BCG or GIV, with or without adjuvant, protected a significant portion of the vaccinated population, as compared with the nonvaccinated controls, with the exception of a group of male mice vaccinated with 0.1 mg. of GIV with adjuvant and challenged with 0.75 mg of virulent tubercle bacilli. GIV with adjuvant protected significantly greater proportions of the mice than did the vaccine without adjuvant. BCG protected a significantly greater proportion of the animals than 0.1 or 0.4 mg of GIV, with or without adjuvant, but the protection afforded by a single 1.6-mg dose or four doses of 0.1 mg of GIV with adjuvant was statistically equivalent to that of BCG. Cobalt-60-irradiated M. tuberculosis H37Rv, although unable to grow on culture media and to produce disease in lab animals, respires on suitable substrates. In acid-fast stained films the irradiated cells cannot be distinguished, morphologically or tinctorially, from the nonirradiated cells. Such γ-irradiated cells, produced from a virulent pathogen, have the advantage of a living attenuated vaccine, i.e., ability to metabolize, without its disadvantages, i.e., genetic differences from the virulent organism (such as with BCG) and the possibility of producing disease in susceptible animals (not a major problem with BCG vaccine). The major disadvantage of the BCG vaccine is its instability, since exposure to temperatures above 4°C for a few days or to light for a few hours or even a few minutes may affect its potency. Whether the same factors will adversely affect the γ-irradiated vaccine has yet to be explored. (BBB)

15825 EFFECT OF X-RAY LYMPHOPENIA ON CONTACT DERMATITIS: FAILURE OF WHOLE-BODY X-IRRADIATION TO INHIBIT THE DELAYED HYPERSENSITIVITY CHALLENGE RESPONSE IN THE GUINEA PIG. Henry C. Maguire (Univ. of Pennsylvania, Philadelphia) and Howard I. Maibach. Arch. Dermatol., 88: 768-70 (Dec. 1963).

It has been reported previously that whole-body x irradiation specifically inhibits the allergic contact dermatitis reaction in sensitized guinea pigs, and this effect was correlated with x-ray-induced lymphopenia. Similar results have been reported using specific antilymphocyte antisera (which produces a far less profound lymphopenia). However, the present authors were unable to confirm that x-ray-induced lymphopenia specifically attenuates the allergic contact dermatitis reaction. Lymphopenia did not correlate with decreased allergic contact skin reactivity, and whole-body x irradiation over a wide range did not specifically inhibit the elicitation of allergic contact dermatitis. Thus, doses of 320 to 2500 r did not attenuate specifically the challenge response in dinitrochlorobenzene (DNCB)-sensitized guinea pigs, although lymphocyte counts fell sharply. Unrelated to the degree of leukopenia, severely marasmic animals showed clear-cut inhibition of cutaneous reactivity. This was true whether the challenge was allergen (DNCB) or a primary irritant (croton oil). These conclusions were reinforced by parallel experiments using cyclophosphamide (Cytoxan) as leukopenogen. The findings argue against the view that the antibody-like factor

of delayed hypersensitivity remains fixed, until the last moment, to blood lymphocytes, but with the notion that a delayed hypersensitivity antibody-like material circulates in the serum of sensitized animals. (BBB)

15826 EFFECTS OF HEAVY HIGH-ENERGY CHARGED PARTICLES. I. LITERATURE REVIEW OF EFFECTS OF PROTONS, DEUTERONS, AND α-PARTICLES IN MAMMALS WITH A THEORETICAL CONSIDERATION OF THE NEGATIVE π-MESON. Stuart W. Lippincott (Bowman Gray School of Medicine, Winston-Salem, N. C.), William H. Moore, Jr., John E. Jesseph, Wenceslao G. Calvo, and Lee E. Farr. Arch. Pathol., 76: 497-526(Nov. 1963).

A review is presented of reported mammalian studies in this field and investigations with cyclotron- and synchrotron-produced particles ranging up to 3-Bev energy are presented. For physicians, an introductory section is included concerning the physical properties and dosimetric considerations of the particles in order to clarify the pertinent facts essential to an understanding of the nature of the transfer, release, and absorption of energy during the traversal of living mammalian tissues by charged particles. This leads to a theoretical consideration of the future possibilities of the negative π meson (π^- meson) which will ultimately be studied in the manner in which protons, deuterons, and α particles are now being investigated. The π^- meson, having a negative charge, will be attracted into the atomic nucleus, and, because of its very strong interaction with nuclear matter, disappears like the photon with creation of an electron pair. Thus the π^- meson is transformed upon interaction with nuclear matter into kinetic energy among the various fragments of the disintegrated nucleus. It is suggested that the π^- meson may become valuable in medical research, particularly in therapeutic situations requiring a favorable tumor-to-entrance dose ratio. In the last centimeter of flight the π^- meson should deliver about 100 Mev, yielding a tumor-to-entrance ratio of about 30 : 1. By comparison, protons of about 130 Mev give a tumor-to-entrance ratio of something like 10.1. The π^- beams are produced by directing protons from large accelerators against metal (usually Cu) targets. It is predicted that improvements in accelerator technology and in magneto-optical focusing of proton beams will make pion beams applicable to biological problems within a few years. Proton and deuteron dosimetry are discussed, as a background to a survey of early medical studies with high-energy particles. The particles and energy ranges employed have been protons from 10 to 660 Mev, deuterons from 20 to 400 Mev, and α particles from 40 to 910 Mev. Many studies have been devoted to the histopathological effects of irradiation upon the normal brain, pituitary, spinal cord, and to a very limited extent upon the peripheral nerves, lens of eye, and labyrinth, usually with local, but in some instances with whole-body irradiations. These basic studies bear a pertinent relation to certain problems in space medicine. High-energy proton beams have been demonstrated to be useful, with considerable precision, as a neurosurgical tool to ablate selected regions within the brain. Studies on the treatment of animal and human neoplasms, using the advantages that particle radiation (Bragg-peak effect) have as compared to electromagnetic radiation, are discussed. (BBB)

15827 EFFECTS OF HEAVY HIGH-ENERGY CHARGED PARTICLES. II. PRIMARY ATYPICAL EPITHELIAL HYPERPLASIA IN MOUSE SKIN AFTER EXPOSURE TO 10-Mev PROTONS, 20-Mev DEUTERONS, OR 30-Mev α-PARTICLES. Stuart W. Lippincott (Bowman Gray School of Medicine, Winston-Salem, N. C.), John E. Jesseph, Charles P. Baker, Wenceslao G. Calvo, Cornelius R. Jansen, Kanti R. Rai, and Vicente Alcober. Arch. Pathol., 76: 527-36(Nov. 1963).

The direct effect of ionizing radiation upon mouse epidermis was investigated by using an external beam of these accelerator-produced monoenergetic, heavy ionizing particles. These particles have a finite, energy-dependent range of penetration in tissue. Ionization occurs throughout the entire path of the particles with a final rise to a peak (Bragg peak) just before the end of the path is reached. By introduction of a rotating disc filter of varying thickness in the form of a wheel revolving in front of the radiation port it was possible to deliver a series of Bragg peaks. In this way a cylinder of skin was irradiated with resultant nearly uniform ionization limited to a total depth of 1 to 2 mm, depending upon the particle and energy selected for the experiment. This approach is important, since apparently cellular damage in irradiated tissue depends not only upon the number of ions absorbed in a given volume of tissue but also upon the density of ionization. The gross appearance of the postirradiated skin areas was similar for all three types of particles employed at 2000 to 5000 rad. Up to two days no obvious alteration was noted, but by the 3rd to 4th day the exposed areas were erythematous. By 6 to 7 days, the skin was thickened and indurated with superficial desquamation and epilation. A thin, dry eschar formed by the 10th to 14th day, with progressive contractive. After 25 to 30 days the irradiated areas were shiny and elevated, measuring from 5 to 8 mm in dia. After an exposure to 1200 rad of protons, at three days there was no microscopic alteration in the epidermis except alteration of some hair follicles. At 7 days the epidermis showed an increase in the width due to increase in the size and number of epithelial cells together with hyperkeratosis. Large vacuolated nuclei with big nucleoli were in evidence. No changes were seen in the capillaries or arterioles. By the tenth day the width of the epidermis had increased further, and as many as 4 to 5 layers of epithelial cells were observed. At 20 days epithelial hyperplasia was marked. After exposure to 2000 and 5000 rad of deuterons, protons, or α particles the epithelial hyperplastic changes appeared earlier and were more pronounced. In some instances the epidermal lesions resulting from an exposure of 2000 to 5000 rad resembled the type of lesion considered in the skin of man to be carcinoma in situ. Changes in underlying blood vessels and collagen were slight. (BBB)

15828 EFFECTS OF HEAVY HIGH ENERGY CHARGED PARTICLES. III. IN VIVO ACTIVATION IN MICE OF C^{12}, N^{14}, AND O^{16} BY BOMBARDMENT WITH 2-Bev PROTONS. Stuart W. Lippincott, John E. Jesseph, William H. Moore, Jr., and Rita F. Straub (Bowman Gray School of Medicine, Winston-Salem, N. C.). Arch. Pathol., 76: 537-42(Nov. 1963).

Preliminary to a study of the effects of high-energy protons on living mammals, mice were bombarded with 2-Bev protons to determine whether radioactivity could be induced in them so that an animal might be its own biological dosimeter with reference to the actual number of protons received from an irradiation exposure. The presence of induced activity arose from the nuclear reactions: $C^{12}(p,pn)C^{11}$; $N^{14}(p,pn)N^{13}$; and $O^{16}(p,pn)O^{15}$. The neutron deficient radionuclides produced had half lives of: C^{11}, 20.4 min; N^{13}, 11 min; and O^{15}, 2.8 min. Therefore, the experimental design was such that for a given counting geometry and known efficiency it would be possible to calculate the proton flux for a wide range of fluxes and exposures, including the lethal range. The observed C^{11} counts,

corrected for decay during bombardment of whole, live mice, were proportional to the proton flux of 7 different bombardments by a factor of $4.09 \pm 0.45 \times 10^{-5}$ C-sec/proton-min for a given counting geometry. At known counting efficiency and times, the proton flux could be calculated for a wide range of fluxes and total exposures, including the lethal range. Since the counting rate of the proton-induced C^{11} activity in the mice has been shown to be proportional to the proton flux to ±10%, the suitability of this counting technique for precise in vivo dosimetry is dependent upon detailed knowledge of beam homogeneity, depth-dose distribution, and other physical variables. The decay curves from dead mice showed that decay of O^{15} and N^{13} could be readily identified. In comparison, the apparent decay of both these elements in the live mice was much faster, the difference being related to the metabolic turnover of one or more of the activated elements in the living animals. (BBB)

15829 EFFECTS OF HEAVY HIGH ENERGY CHARGED PARTICLES. IV. THE FATE OF GIANT CELLS PRODUCED IN A NEOPLASM BY 20-Mev DEUTERON BOMBARDMENT. Stuart W. Lippincott (Bowman Gray School of Medicine, Winston-Salem, N. C.), Wenceslao G. Calvo, Charles P. Baker, John E. Jesseph, Carnelius R. Jansen, and Lee E. Farr. Arch. Pathol., 76: 543-52(Nov. 1963).

Experiments were designed to bombard transplantable mouse Sarcoma 37 with a beam of 20-Mev deuterons from the Brookhaven 60-in. cyclotron. In the first studies, 1-mm cube of tumor was irradiated in vitro and immediately transplanted so that if giant cells developed they could be recognized clearly as not having arisen from the host, and their subsequent capacity to reproduce could be determined. In the second study, tumor was transplanted before being irradiated in vivo. In both experiments giant tumor cells developed as a result of bombardment with deuterons, and their microscopic appearance and biological behavior were studied. In both experiments certain changes common to each were noted. At the lowest dose (400 rad) no giant tumor cells were found. At the other extreme, exposures of 10,000 and 50,000 rad proved to be very rapidly cytocidal to the neoplastic cells. Profound alterations occurred in the neoplastic tissue at doses of 2500 to 3000 rad with formation of giant cells and death of most of the neoplastic cells by 72 to 96 hr. By then most of the residual tumor cells were enlarged up to about 10 times normal size; nuclei increased in size and chromatic content, with prominent nucleoli. By the 7th to 10th days after irradiation, giant neoplastic cells were no longer found and all traces of neoplastic cells had disappeared, whereas in the nonirradiated transplanted neoplasms at these periods growth was profuse. (BBB)

15830 RADIATION NECROSIS OF THE CEREBELLUM AFTER SINGLE, HIGH-DOSAGE X IRRADIATION. Norbert Schuemmelfeder, Karl-Jochen Ebschner, Hans-Dieter Bergeder, and Erik Krogh (Universität, Bonn). Arch. Pathol. Anat. Physiol., 334: 32-55(1961). (In German)

Histopathologic changes were examined following exposure to a single high dose of 50-kv x rays of the cerebellum of mice (10 to 60 kr at a rate of 3 kr/min to the surface of the cerebellum). Within the first hours, morphologic signs of radiation damage in the cerebellar cortex were observed; these were limited strictly to the irradiated field (3 × 3 mm). The first pathological finding observed was nuclear and cytoplasmic swelling in the nerve cells of the molecular and granular layers. In addition to these changes, at a sufficiently high x-ray doses (40 to 60 kr), vacuolation of the interstitial material was present within the molecular layer. The swelling of the nerve cells was followed by a second phase of the radiation damage which revealed interstitial edema and increasing nuclear pyknosis of the irradiated nerve cells of the molecular and granular layers. In the subsequent, third phase of the radiation damage, necrosis of irradiated cerebellar tissue occurred. Severity and appearance as well as the development of this acute radionecrosis were related to the x-ray dose. Sequence and full manifestation of this necrosis could be followed only by using lower x-ray doses (10 to 20 kr). A latent period of 1 to 20 days was noted for full manifestation of brain necrosis. The early cellular reaction, within a few hours of irradiation, is attributed to the direct effects of radiation on intracellular structures, possibly enzymes or nucleic acids. The second, or edematous, phase is attributed to radioinduced increase of vascular permeability of leaking of fluid from the blood vessels into intercellular space. The nuclear pyknosis occurring in this phase is the result of primary cell damage and not secondary to the subsequent edema, since edema beyond the irradiated area did not cause pyknosis of cell nuclei. Late brain cell injury is caused by proliferation and subsequent hyalinization of blood vessels resulting in interruption of flow of metabolites from the circulation to brain cells. It is concluded that radiation injury to the brain stems from the combined effects of primary damage to parenchymal cells followed by vascular disturbances depriving the cells of nutrient materials, both processes leading to death of neural cells and replacement by fibrous tissue. (BBB)

15831 DEOXYRIBONUCLEIC ACID POLYMERASE IN L CELLS. II. DEOXYRIBONUCLEIC ACID POLYMERASE ACTIVITY IN EXTRACTS OF CELLS TREATED WITH X-RAYS. Marvin Gold, Christopher W. Helleiner, and Maire Percy (Univ. of Toronto). Biochim. Biophys. Acta, 80: 204-12(Feb. 17, 1964).

When randomly growing cultures of L cells were irradiated with 1000 to 3000 rads of x rays, DNA synthesis continued for a time, stopped briefly, and was then resumed. The timing of these events depended on the dose of x rays. The DNA polymerase (deoxynucleosidetriphosphate: DNA nucleotidyltransferase, EC 2.7.7.7) activity of extracts made from cells irradiated in this way reached a minimum when DNA synthesis was stopped. When synchronized cultures of L cells were irradiated with x rays, DNA synthesis and cell division were delayed. The decrease in the activity of DNA polymerase normally seen in extracts of cells engaged in active DNA synthesis was also delayed by the irradiation. These effects were dependent on the dose and also on the time when the dose was administered. (C.H.)

15832 DARK REACTIVATION OF ULTRAVIOLET IRRADIATED BACTERIOPHAGE DEOXYRIBONUCLEIC ACID IN VITRO. A. Roersch, Cornelia van der Kamp, and Jacoba Adema (National Defense Research Organization TNO, Rijswijk, Netherlands). Biochim. Biophys. Acta, 80: 346-8(Feb. 17, 1964).

Preincubation of irradiated RF-DNA with an enzyme preparation from Micrococcus lysodeikticus led to a marked increase of the biological activity of the DNA in hcr^- spheroplasts. A cell-free extract of M. lysodeikticus was brought to 55% saturation with ammonium sulfate, the precipitate was collected and redissolved in 0.01 M phosphate buffer (pH 7.0). 0.1 ml of these preparations (1 mg-protein/ml) were incubated for 30 min at 37° with 0.1 ml uv-irradiated and nonirradiated solutions of RF-DNA (1 μg DNA/ml). After incubation the mixtures were diluted one in ten in phosphate buffer; 0.1 ml of these dilutions were added to spheroplast suspensions of wild type E. coli K 12 S

hcr^+ and of its hcr^- mutant. The results of a number of representative experiments are summarized. The preincubation with the enzyme preparation had a negligible effect on the activity of nonirradiated DNA; the biological activity of irradiated DNA was strongly enhanced only when its activity was estimated in hcr^- spheroplasts (dose reduction 2.6) and not in hcr^+ spheroplasts. This indicates that the reaction in vitro replaces to a certain extent the genetically determined dark-reactivation capacity of the wild type. The thermolability of the active component suggests that the reaction is of enzymic nature. The reactivated DNA fraction increased with the length of the preincubation period which indicates that the reaction occurs in vitro and that the effect is not due to an activation of the spheroplast system. The residual reactivation observed when an undiluted enzyme preparation was added at zero time was due to the proceeding of the reactivation process during the 10-min absorption period of the DNA to the spheroplasts. Extensive dialysis did not reduce the activity of the enzyme preparation nor did the addition of Mg^{2+} stimulate it. (C.H.)

15833 A METHOD FOR INVESTIGATION OF STEM-CELL KINETICS. C. W. Gurney, L. G. Lajtha, and R. Oliver (Churchill Hospital, Oxford). Brit. J. Haematol., 8: 461-6(1962).

A new radiobiologic method for investigation of stem cells is presented and some limitations of the Fe^{59} method of estimating erythropoiesis are pointed out. The technique was conducted by giving young adult mice two daily intraperitoneal injections of homologous red cells. By 5 days after the second transfusion, erythrocyte formation was almost completely eliminated, and at varying times after total-body x irradiation, the functional integrity of the stem-cell compartment was tested by determining the response to a subcutaneous stimulating dose of 6 units of erythropoietin per mouse. Forty-eight hr later, when the wave of erythropoiesis induced by erythropoietin was entering its late stage, 5 μC of $Fe^{59}Cl_3$ was administered intraperitoneally. Seventy-two hr after the injection of radioiron, animals were sacrificed and the per cent radioiron incorporated by newly formed erythrocytes was determined. A plot of Fe^{59} incorporated into newly formed erythrocytes against the radiation dose in roentgens yielded a curve with a 37% dose slope of about 110 rad and an extrapolation number (to no radiation) of about 1.2 to 1.3. When the incorporation of radioiron was plotted as a function of the time between irradiation and administration of erythropoietin, a dip in the number of available stem cells 24 hr after irradiation was seen. At 5 days after irradiation the stem-cell compartment was not appreciably more receptive to the stimulating action of a standard dose of erythropoietin than it was immediately after irradiation. Recovery was then rapid, however, and in the next 24 hr became complete. The erythropoietic response, as measured by incorporation of a tracer dose of Fe^{59}, to 6 units of erythropoietin was as effective 6 or 7 days after 150 r as it is in nonirradiated mice. The sequence of events are described as: immediate damage (at 0 time), postirradiation dip (at 24 hr), abortive recovery (48 hr to 5 days), and ultimate recovery (5 to 7 days). Serum Fe levels rose sharply in the normal rat following whole-body irradiation; however, such a change does not occur in transfused rats. This is due to the striking reduction in erythropoiesis prior to irradiation, and to the greatly elevated plasma iron resulting from the daily breakdown of the increased red-cell mass. Nevertheless, the plasma iron would be expected to fall when erythropoiesis is reinstituted in the polycythemic animal by erythropoietin. This fall is probably progressively less as the radiation dose increases and inhibits response to erythropoietin. Consequently, suitable corrections for this have to be made. (BBB)

15834 DOES NITROGEN MUSTARD MIMIC THE X-RAY EFFECTS IN ANY CASE? M. Mueller and N. Skreb (Inst. of Biology, Zagreb). Experientia, 20: 70-1(1964).

The effects of nitrogen mustard on brain development in rats were analyzed and compared with data of Hicks (Physiol. Rev., 38: 337(1958)) on x-ray effects. It was possible to show by histological analysis that the brain and the eye were damaged but in a manner different from that after x rays and heat shock. The rosettes of the mitotic cells started to form rapidly after radiation, but this did not occur after doses of nitrogen mustard. It was concluded that the nitrogen mustard mimics the x-ray effects only roughly. (M.C.G.)

15835 EFFECT OF X-IRRADIATION ON DNA SYNTHESIS IN POLYOMA VIRUS-INFECTED CULTURES. AUTORADIOGRAPHIC STUDIES. J. Minowada (Roswell Park Memorial Inst., Buffalo). Exptl. Cell Res., 33: 161-75(Jan. 1964).

Autoradiographic and immunofluorescent methods are described that were used to study the effects of x radiation on DNA synthesis in mouse embryo tissue cultures infected with polyoma virus. The increase in DNA synthesis induced by the virus infection was due to both host and viral DNA. In irradiated infected cells the increase in DNA synthesis was due to newly synthesized viral DNA. (C.H.)

15836 HUMORAL FACTORS IN CNS CHANGES IN EXPERIMENTAL RADIATION SICKNESS. P. D. Gorizontov and E. N. Shcherbova. Federation Proc., Transl. Suppl., Pt. II, 23: T284-6(Mar.-Apr. 1964). (Translated from Patol. Fiziol. i Eksperim. Terapiya, 7: No. 1, p.14, 1963).

Irradiation of single rats with a dose of 1100 r gives rise to Central Nervous System (CNS) changes in the form of the phases of increased and reduced cortical activity and alterations of the reactivity and excitability threshold of the cortex. Unexpectedly, however, the changes are much greater in a parabiotic partner subjected to irradiation of the same order than in intact animals. Exposure of single rats to 25 r has a very mild effect on the cerebral activity. In a parabiont under identical conditions the same dose produces marked electroencephalographic (EEG) changes that are to a certain extent similar to changes produced by the dose of 1100 r in the unprotected partner. Results indicate that changes in the humoral medium of the body have an important effect on the development of radiation induced CNS reactions. (auth)

15837 HISTOCHEMICAL INVESTIGATIONS OF GLYCOGEN IN EYEBALL TISSUE IN RADIATION SICKNESS. V. M. Abdullaev (Inst. of Roentgenology and Radiology, Azerbaijanian SSR). Federation Proc., Transl. Suppl., 23: Pt. II, T287-91(Mar.-Apr. 1964). (Translated from Arkh. Patol., 25: No. 3, p.56, 1963).

Dogs and rabbits were irradiated with x-ray doses of 692 and 792 r, respectively. The animals were sacrificed at different periods following irradiation and the enucleated eyeballs embedded in celloidin and paraffin for histochemical study. Glycogen was nonuniformly distributed as granules, lumps, powder, or a homogeneous mass in the normal coats of the eye. A high glycogen content was found in the eye muscles, conjunctival epithelium, sustentacular fibers of Müller, and vessels, especially those of the iris. There was a medium amount of glycogen in the corneal epithelium, rod and cone layer, ciliary muscles, and muscle bundles of the iris. Little glycogen was found in the

outer plexiform and inner nuclear layers of the retina and in the substantia propria. Glycogen was lacking in the endothelium of Descemet's membrane and of the iris, the epithelium of the crystalline lens, and the glial cells of the optic nerve. The content and distribution of glycogen changed, depending on the severity and stage of radiation sickness. Increased glycogen content was noted in the eye muscles, outer layers of the retina, and vitreous body. A decrease was noted in the inner layers of the retina, the conjunctival epithelium, and in the nuclei of the crystalline lens. Glycogen disappeared in the crystalline lens in the areas of homogenation and fibrogenesis. (auth)

15838 AN ATTEMPT TO DETECT AND TITRATE ROUS SARCOMA VIRUS PRODUCING CELLS OF RAT TUMOUR XC ON THE CHORIOALLANTOIC MEMBRANE OF THE CHICK EMBRYO. M. Vrba and D. Chaytor (Inst. of Experimental Biology and Genetics, Prague). Folia Biol. (Prague), 10: 50-3(1964).

The inoculation of a dose of x-irradiated (5,000 r) cells of tumor XC onto the chorioallantoic membrane (CAM) of chicken embryos showed that the proportion of virus-producing cells could not be reliably detected, even when a maximal dose of 3×10^5 cells was used, although a parallel test on chicks showed an activity comparable to that obtained previously with nonirradiated cells. The 7-day cultivation of tumor XC in the CAM and tests for cell-free extracts in chicks did not result in the expected high production of Rous sarcoma virus (RSV). In both cases of virus detection systems, however, the production of RSV in the cells of rat tumor XC was demonstrated. (auth)

15839 URETER AND BLADDER FISTULAS AFTER SURGERY AND IRRADIATION FOR UTERINE CARCINOMA. H. Stamm (Universitat, Basel). Geburtsh. Frauenheilk., 23: 1129-35(Dec. 1963). (In German)

Both surgical and radiation treatment of uterine cancer may lead to fistulas and when the treatments are combined the possibility of fistulas developing is increased. In a study of 234 patients submitted to the Wertheim operation and Ra implantation (1200 mg-hr) + conventional x-ray treatment (9000-12,000 r), 4.7% developed fistulas. In 4 cases the fistula was of the unilateral ureterovaginal type, 3 were bilateral ureterovaginal, and 3 vesicovaginal. These fistulas arose from a ureter that was acutely inflammed, became swollen and stenotic, and then because of connective tissue proliferation, hard and ischemic. Histologically, fistula formation was accompanied by destruction of the epithelium, overgrowth of fibroblasts, injury of the blood vessels, and depostion of iron pigments (hemosiderin). Fistulas developed 14 to 62 days after treatment. The preferred prophylatic measures after combined surgery and radiotherapy include packing the vaginal stump with Sorbacel and local introduction of antibiotics, such as penicillin and streptomycin. Improvement of the blood supply of the ureter should be considered during surgical intervention. Plastic surgical techniques for correction of fistulas are described briefly. (BBB)

15840 FURTHER CHROMOSOMAL STUDIES ON IRRADIATED HUMAN LEUKOCYTES IN VITRO. Akio Awa, Yasushi Ohnuki, and C. M. Pomerat (Hokkaido Univ., Sapporo and Pasadena Foundation for Medical Research, Calif.). Idengaku Zasshi, 38: 106-12(Apr. 1963).

Human leukocyte cultures received x irradiation at a dose of 400 r on the 4th day and were fixed on the 6th day. There was an increase from 0.25 to 3.01% in the number of polyploid cells. These were predominantly tetraploids. Microscopic examination revealed that 64% of metaphases observed showed damage. The abnormalities were due to chromosomal breakages, particularly fragments and dicentrics. Counts and detailed analysis of chromosomes in human cells used as controls demonstrated the predominant distribution of euploid elements with 46 chromosomes. These values closely parallel those reported by Ohnuki et al. (1961). In order to develop a satisfactory culture procedure for rhesus monkey (Macaca mulatta) leukocytes, several technical variations of the routine method were investigated. None of these variations gave satisfactory results for monkey samples, but all were useful for human cells. Such an unusual situation might possibly be induced by differences in the physicochemical and cellular properties of monkey blood and that of man. (auth)

15841 MALT PASTEURIZATION: STERILIZATION OF BARLEY MALT WITH GAMMA RADIATION. Lloyd L. Kempe (Univ. of Michigan, Ann Arbor), John T. Graikoski, J. R. Stratton, and W. H. Day. J. Agr. Food Chem., 12: 98-100(Jan.-Feb. 1964).

Off-flavored distillates are occasionally produced during the processing of grain mashes to beverage alcohol which can be traced to metabolic activities of bacteria that survive the saccharification step in mashing in which the mesh is maintained at 145°F for a short time. Barley malt is the principal source of these bacteria, which are mainly lactobacilli; therefore, attempts were made to sterilize the malt by Co^{60} γ irradiation. It was shown that 0.112-Mrad irradiation reduced the bacterial counts of malts to very low levels whereas no significant reduction in α-amylase or alcohol yields occurred. Higher dosages of radiation resulted in substantially complete sterilization of the malts but also in some destruction of their amylase activities. Pre-irradiation of malt caused progressively lower maximum bacterial populations and lengthened lag phases as more radiation was used; however, the rate of multiplication in the exponential growth phases was not influenced by the amount of radiation. Heating subsequent to irradiation has been shown to have a synergistic lethal effect on bacteria, but no significant difference between irradiated and nonirradiated malts or of saccharification temperature upon alcohol yields was found. In some trials, higher alcohol yields were obtained from irradiated malts used at a saccharification temperature of 125°F, suggesting that some destruction of malt amylase occurs by saccharifying at 145°F. Results using malts treated with γ and cathode rays are compared. A 1% reduction of alcohol yield was caused by 0.4 Mrad of cathode rays and by 1.1 Mrad of γ rays. Beyond the amount of radiation causing 1% reduction, the yields drop rapidly with either kind of radiation. The α-amylase content of malt is not significantly reduced by irradiation with less than 0.04 Mrad of either γ or cathode rays. Beyond 0.04 Mrad, however, the α-amylase content decreases rapidly with both kinds of radiations, no significant difference being apparent between the action of γ and cathode rays on this enzyme. It is estimated that the cost of pasteurization of grain using 0.1 Mrad Co^{60} irradiation would be approximately $2/ton. (BBB)

15842 EFFECT OF ADRENAL IRRADIATION UPON ALDOSTERONE PRODUCTION IN THE RAT. John Q. Griffith, Jr., Martin G. Griffith, Mortimer B. Hermel, Jacob Gershon-Cohen, and Harold G. Loeb. J. Albert Einstein Med. Center, 11: 254-9(Oct. 1963).

Irradiation to the rat adrenal in doses of 500 and 1000 r does not seriously impair its ability to produce aldosterone as determined by direct measurement of urinary aldosterone by a sensitive isotope method. Changes in serum and urine Na and K due to irradiation were not statistically significant. (auth)

15843 LONG-TERM INTRAORAL FINDINGS IN HUMANS AFTER EXPOSURE TO TOTAL-BODY IRRADIATION FROM SUDDEN RADIOACTIVE FALLOUT. I. FIVE-YEAR POSTDETONATION STUDIES. Harvey W. Lyon (Naval Medical Research Inst., Bethesda, Md.), Robert A. Conard, and Kenneth F. Glassford. J. Am. Dental Assoc., 68: 31-8(Jan. 1964). (BNL-6983)

The intraoral clinical findings obtained in March 1959 on Marshallese natives 5 yr after exposure to total-body irradiation from sudden, significant quantities of radioactive fallout are described. This fallout was precipitated on Rongerik atoll, Rongelap atoll, Ailingnae, and Uterik in the Marshall Islands after detonation of a 15-Mt thermonuclear test device at the Bikini Proving Grounds in February 1954. As a result, 239 Marshallese were accidentally exposed to total-body irradiation ranging from 14 to 175 r. Examinations disclosed similar degrees of caries activity in irradiated and nonirradiated children. Although the prevalence of periodontal disease was practically identical in both the irradiated and nonirradiated groups, the extent of periodontal destruction was greater in the irradiated Rongelapese. This difference may or may not be related to factors such as leukopenia and lower tissue resistance and the presence of preexisting periodontal disease. Children born of irradiated parents, including those children in utero at the time of initial exposure, and irradiated children 6 to 18 yr old, showed no evidence of any morphologic effects on oral tissues from total-body irradiation when compared with the nonirradiated control groups. No evidence of intraoral neoplasm was noted; however, one 42-yr-old irradiated Rongelap man had a small leukoplakic-like lesion on the gingiva. No clear relation of radiation exposure in the Rongelap people to the higher levels of periodontal destruction in this group is suggested. Because of the generally substandard levels of oral hygiene among the Marshallese, it is likely that the disease was prevalent at the time of their radiation exposure. However, the period of leukopenia after this group's exposure might have enhanced the progress of periodontal disease, although they showed no evidence of increased infection, oral or otherwise, or bleeding tendency during the period of leukopenia and thrombocytopenia. (BBB)

15844 RESISTANCE AND CROSS-RESISTANCE OF ESCHERICHIA COLI S MUTANTS TO THE RADIOMIMETIC AGENT PROFLAVINE. Pearl Woody-Karrer and Joseph Greenberg (Palo Alto Medical Research Foundation, Calif.). J. Bacteriol., 87: 536-42(Mar. 1964).

All 50 of the first-step mutants of Escherichia coli S selected for resistance to proflavine were resistant to uv light and each of five different radiomimetic chemicals. The mutants were classified into eight types on the basis of their relative resistance to six different radiomimetic drugs and on the basis of the shape of their uv survival curves. Three of these types are identical to types previously isolated with other radiomimetic drugs; five of the types are new. A high proportion of the clones surviving proflavine treatment were phenotypically but not genetically resistant, and no strains were isolated which were resistant to proflavine but were not resistant to radiation. (auth)

15845 RADIOSENSITIVITY OF SEVERAL DEHYDROGENASES AND TRANSAMINASES DURING SPOROGENESIS OF BACILLUS SUBTILUS. D. B. Rowley and H. R. Newcomb (Syracuse Univ., N. Y.). J. Bacteriol., 87: 701-9 (Mar. 1964).

Cells of Bacillus subtilis grown in a chemically defined medium for 17 hr, subsequently washed, and transferred to a phosphate solution containing $CaCl_2$ sporulated in a reproducible pattern. The synthesis of dipicolinic acid essentially paralleled the appearance of thermoresistant cells. X-ray resistant cells appeared 2 to 3 hr before the appearance of thermoresistant cells and the formation of dipicolinic acid. Changes in enzyme activity of cells undergoing sporogenesis varied among the enzymes studied. The transaminases exhibited a marked decrease in activity during early sporogenesis, whereas the dehydrogenases exhibited maximal activity. The determination of enzyme radioresistance in extracts of sporulating cells indicated that the resistance of transaminases remained essentially unchanged, whereas the dehydrogenases exhibited a decreased resistance early in sporogenesis. Although both glutamic-pyruvic transaminase and glutamic-oxaloacetic transaminase (GOT) were demonstrated in vegetative cells, only the latter was detected in mature spores. The radioresistance of GOT in vegetative-cell extracts was two to three times greater than in spore extracts. (auth)

15846 ANALYSIS OF A GENE CONTROLLING CELL DIVISION AND SENSITIVITY TO RADIATION IN ESCHERICHIA COLI. Howard I. Adler and Alice A. Hardigree (Oak Ridge National Lab., Tenn.). J. Bacteriol., 87: 720-6(Mar. 1964).

Radiosensitivity in Escherichia coli is under control of genes that are transferred during conjugation between donor and recipient strains. Conjugation experiments establish that one of these genes occupies a locus on the E. coli K-12 linkage map between the genes controlling ability to utilize lactose and galactose. It affects sensitivity to both ionizing and uv (2,537 A) radiation. A strain possessing a mutation at this locus fails to show increases in resistance to ionizing radiation during late lag and early log phases, and increases in resistance when grown to stationary phase in a glucose-containing complete medium. The primary effect of the mutation at this locus may be an interference with the mechanism by which cells form cross plates. Cells of the mutant form long, nonseptate filaments when grown after exposure to ionizing radiation. The filaments do not give rise to macrocolonies. Pantoyl lactone, an agent that initiates cross plate formation, allows the filaments to divide normally and produce macrocolonies. When plated after irradiation on complete medium containing pantoyl lactone, the survival of the mutant is greatly increased. (auth)

15847 BONE MARROW DISTRIBUTION AS A FACTOR IN ESTIMATING RADIATION TO THE BLOOD-FORMING ORGANS: A SURVEY OF PRESENT KNOWLEDGE. H. R. Atkinson (Dominion X-ray and Radium Lab., Christchurch, New Zealand). J. Coll. Radiologists Australasia, 6: 149-54(Dec. 1962).

Information on bone marrow distribution is collected and collated. The variation in active marrow distribution with age is considered, together with assumptions that this extension introduces. Distributions that have been adopted to estimate radiation doses to the marrow are compared. A table is provided showing distribution of active marrow in major bone groups at various ages, based on data from 100 cadavers. The data cannot be applied with mathematical accuracy to a given case. Inactive marrow may quickly be transformed to active marrow in patients who have infections or conditions which impose a stress on the hematopoietic system. By applying cellularity data as a cellularity factor for each age, the distribution of active marrow at the age was gained. Total values at different ages give a measure, or baseline, for the active marrow that is re-

quired for maintaining a normal physiological function, but do not represent weights of marrow. For each given bone group, at each age, the percentage of total active marrow was calculated. The resultant distribution of percentage total active marrow is shown graphically. This percentage distribution of active marrow is the quantity required in studies of radiation effects on the blood-forming organs. Doses incident on the marrow of part of the body may then be weighted for the proportion of active marrow that is within the radiation field. Approximations within the basic data that were used to construct this distribution are discussed. It was assumed that the adult distribution of marrow spaces may also be used as the distribution of marrow spaces in children. Additional tables are provided showing marrow distribution in major body areas, since in many medical procedures parts of bones intercept a radiation field; e.g., in a given radiotherapeutic technique, fields may cover the pelvis and lumbar vertebrae only. Without details of the relative amounts of marrow within the several parts, cruder estimates of the proportion of marrow irradiated have to be made. So that a finer subdivision should be available, details for several of the bone groups have been listed in tables for ribs and vertebrae, and for the head, pelvis, and limbs. Active marrow content at a given age can be estimated by using appropriate cellularity factors as earlier described for the principal bone groups. The estimates presented here are compared with those of several previous surveys. (BBB)

15848 IRRADIATION-INDUCED CHANGES IN MILK FAT. E. A. Day and S. E. Papaioannou (Oregon State Univ., Corvallis). J. Dairy Sci., 46: 1201-6(Nov. 1963).

Milk fat irradiated under reduced pressure exhibits a flavor atypical of that encountered through autoxidation, with a candle-like flavor component predominant. Apparently, this flavor is attributable to hydroperoxides. Investigations were undertaken to describe this flavor and other changes effected by irradiation. When milk fat under reduced atmospheric pressure was exposed to 1.5 to 4.5 Mrad Co^{60} γ irradiation, free monocarbonyls were produced at a rate proportional to dose. The 2-thiobarbituric acid number and total carbonyls increased, but not at a linear rate. Small quantities of hydroperoxides were produced; radiation dosages higher than 1.5 Mrad decreased the concentration. The flavor of the irradiated fat appeared to have three components: hydrolytic rancidity, oxidized, and candle-like. The monocarbonyls of irradiated fat were isolated and analyzed by gas chromatography and as 2,4-dinitrophenylhydrazine derivatives. Alkanals predominated and their order of decreasing concentration in the irradiated fat was: C_{16}, C_{15}, C_{14}, C_{12}, C_{10}, C_6, C_8, C_7, C_4, iso-C_4, C_9, C_5, C_3, C_2, C_1. Methyl ketones also were produced by irradiation and the following compounds were found: C_{15}, C_{11}, C_9, C_7, C_5, C_4. Evidence is presented indicating that the long-chain aldehydes are responsible for the candle-like defect. It is suggested that the long-chain aldehydes and methyl ketones are produced via hydrolytic rather than oxidative mechanisms. At a dose of 3.0 Mrad, most of the carotenoids in the fat were destroyed, as evidenced by the bleached appearance of the fat. Although the fat was sealed under reduced pressure, irradiation caused production of gaseous materials, as seen by bulging of the cans. (BBB)

15849 VARIABLE REWARDS AND PERIPHERAL CUES IN DISCRIMINATIONS BY IRRADIATED AND NONIRRADIATED MONKEYS. Roger T. Davis and William E. Lovelace (Univ. of South Dakota, Vermillion). J. Genet. Psychol., 103: 201-5(Dec. 1963).

It has been reported that nonirradiated monkeys associated peripherally placed stimuli with stimuli that were available for problem solving, and monkeys that had survived large doses of whole-body radiation with mixed source of radiation did not. This was interpreted as indicating that the response threshold of irradiated monkeys is displaced and their attention is narrowed. The present study was designed to determine whether the effect previously reported was related to changes in preferences of irradiated and nonirradiated monkeys for foods. Raisins and celery were selected as rewards, and it was hypothesized that a strong incentive (raisin) would cause the animals to attend to the problem at hand and ignore peripheral cues, whereas a weak incentive (celery) would favor the use of peripheral cues. Also, if groups differ in their preference for the incentives, this should be reflected in their ability to use peripheral cues. The test monkeys had survived three large doses of whole-body irradiation which were given 6, 7, and 8 yr earlier and totaled 1100 r. The results revealed three significant effects. One, which occurred with raisin rewards, was the tendency for irradiated monkeys to do less well on the second problem than on the first. This was the effect that had been reported under the same condition of reward. The effect was also significant during the second and third, but not during the first time the condition using raisins was presented. More striking was the effect produced by giving two different incentives. Every subject made a higher percentage of errors under celery than under raisin reward. Also, the effect disappeared under celery reward and there was a decline in errors between the first and second problems with celery rewards. Thus, the effect disappears under a weak incentive. This supports the hypothesis that differences in food preferences of irradiated and nonirradiated monkeys explain the phenomenon of a narrowing of attention to stimuli. (BBB)

15850 MINIMUM-SEPARABLE VISUAL ACUITY OF RHESUS MONKEYS AS A FUNCTION OF AGING AND WHOLE-BODY RADIATION WITH X-RAYS. William E. Lovelace and Roger T. Davis (Univ. of South Dakota, Vermillion). J. Genet. Psychol., 103: 251-7(Dec. 1963).

An investigation was made of minimum-separable visual acuity of rhesus monkeys as a function of aging and exposure to x rays, as a continuation of earlier experiments which reported deficits in minimum-separable visual acuity of monkeys that had been exposed to large doses of mixed neutron and γ radiation (1100 r) 7 yr earlier. Three groups of five monkeys each were used, consisting of an aged irradiated group, an aged nonirradiated group, and a young nonirradiated group. The stimuli consisted of a complete circle paired with a broken circle which had 10 successively more difficult stages. The broken circle had forms varying from a circle with a 180° break to a circle with a 0.5° break. Training was divided into three phases: preliminary training, generalization training, and acuity training. The results showed that the young monkeys were able to generalize significantly better than aged monkeys; however, no significant differences in acuity or preliminary training occurred between the two groups of old subjects. There were no significant differences in performance between old irradiated and nonirradiated monkeys in preliminary training, generalization training, or acuity training. Chronic radiation effects in minimum-separable visual acuity were not detected. Evidence of the emotional effects of frustration on the production of errors at the threshold of acuity was found, and the three groups appeared to be affected differently, it being most pronounced in the young monkeys. (BBB)

15851 RESPONSE LATENCIES OF NORMAL AND FOCAL-HEAD IRRADIATED MONKEYS. A. A. McDowell and W. Lynn Brown (Univ. of Texas, Austin). J. Genet. Psychol., 103: 325-9(Dec. 1963).

This study was designed to determine whether focal-head irradiated rhesus monkeys differ from normal monkeys in a manner analogous to that previously found in whole-body irradiated monkeys with respect to response latencies under both familiar and novel stimulus conditions. Five control and four focal-head irradiated rhesus monkeys with nearly identical training histories were used; the latter were survivors of a focal-head irradiation study conducted four years earlier. They had received 3000 r x radiation to the inferior parietal lobule and posterior aspect of the temporal lobe of the brain, and 30 days later the same dosage to the same area of the brain. The testing was conducted in a modified version of the Wisconsin General Test Apparatus, with 24 trials per day for two days, on response latency to a single food-rewarded wooden block placed randomly over either of the two extreme food-well positions. Then, 24 trials were conducted per day for two days on response latency to either the same food-rewarded wooden block or to a novel nonrewarded wooden block presented simultaneously. On the single-block condition, median response latencies of the two groups were comparable and the groups improved in a similar manner with practice. Optimal performance latencies were also comparable for the two groups. When the novel nonrewarded stimulus block was introduced, both groups manifested comparable disruption of median response latencies, but disruption of optimal response latencies was shown only by the focal-head irradiated group. The findings show that monkeys with previous focal-head irradiation of the posterior association areas, unlike relatively high-dose whole-body irradiated monkeys, manifest median response latencies comparable to those of controls. These data indicate the lasting effects of focal-head irradiation with x rays, and suggest that the sites of permanent damage for monkeys given sublethal whole-body radiation exposure differ from the sites irradiated in the present subjects. (BBB)

15852 SOME DIFFERENCES IN EXTINCTION BY NORMAL AND WHOLE-BODY IRRADIATED MONKEYS. A. A. McDowell and W. Lynn Brown (Univ. of Texas, Austin). J. Genet. Psychol., 103: 335-40(Dec. 1963).

An extinction criterion was sought which would differentiate irradiated and normal monkeys. Four normal and 16 whole-body irradiated male rhesus monkeys used were the survivors of a study of radiation effects conducted 5 yr earlier. The estimated total dosages received from a mixed γ and neutron radiation source were 0, 77, 154, 308, and 616 rep. The Wisconsin General Test Apparatus was used for testing. The stimuli for testing were two wooden test objects differing in multiple dimensions, and each monkey was tested for 24 trials on discrimination of the food-rewarded stimulus from the stimulus that was consistently nonrewarded. During the last 10 trials, the median errors for the control and irradiated groups, respectively, were 1 and 0, the mean median response latencies were 17.1 and 20.2 millimin, and the median frequencies of response latencies as large or larger than 50 millimin were 0 and 0. There was no significant difference with respect to each of these three variables in the two groups. During extinction, the irradiated monkeys achieved response latencies of 50 millimin or more faster than did the controls. The irradiated monkeys had more response latencies at or above 50 millimin than did the controls. Monkeys of the two higher radiation dosage groups had a comparable number of response latencies at or beyond the extinction criterion and more than those of the low-dose group. The data support a hypothesis of facilitation of extinction by exposure to radiation. These findings reflect another facet of the increased concentration of attention of irradiated monkeys, which facilitates the perception of any change associated with the site of food reward. They are consistent with earlier results which have shown facilitation of acquisition and retention accruing to radiation exposure, and extend the realm of facilitative effects of radiation exposure to include extinction. (BBB)

15853 SOME COMPARISONS OF NORMAL AND IRRADIATED MONKEYS ON BETWEEN-DAY REVERSAL LEARNING. A. A. McDowell and W. Lynn Brown (Univ. of Texas, Austin). J. Genet. Psychol., 103: 369-72(Dec. 1963).

A comparison was made of the learning performance of normal and whole-body irradiated monkeys on successive reversals of the same discrimination problem. The 20 male rhesus monkeys used were survivors of a 6½-yr earlier study of behavioral effects of whole-body exposure to radiation. The dose range for a low-dose group was between 10 and 16 rep neutron plus 70 to 140 r γ radiation, and the dose range received by the high-dose group was between 27 and 54 rep plus 284 to 557 r, the source including both γ and neutron radiation. All training was conducted in a modified version of the Wisconsin General Test Apparatus. The four normal, six low-dose, and 10 high-dose irradiated monkeys were tested for 10 days on a two-object discrimination problem with the valences of the objects held constant within each day of testing, but alternated between successive days of testing. Each monkey was tested each day to the criterion of 10 successive responses to the object holding the positive valence for the day. Statistical analyses of the data over successive three-day periods of the nine days of reversal training showed that difference between radiation groups with respect to errors to initial correct response was beyond the 0.005 significance level. The frequency of occurrence of this variable, as well as the difference between groups, was stable over time. Errors to initial correct response varied directly with radiation dose. The radiation groups failed to differ significantly with respect to the achievement of a stable criterion of learning during reversal training, both in terms of errors to criterion and trials to criterion. The findings are equivocal, but the greater frequency of errors to initial correct response for the irradiated monkeys may reflect decreased capacity to solve successive discrimination-reversal problems. Or, the greater frequency of errors to initial correct response for the irradiated monkeys may reflect increased capacity for retention between days of training. The second interpretation is suggested as the more plausible one. (BBB)

15854 THE USE OF GAMMA RADIATION FOR THE ELIMINATION OF SALMONELLAE FROM VARIOUS FOODS. F. J. Ley (Atomic Energy Research Establishment, Wantage, Berks, Eng.), Barbara M. Freeman, and Betty C. Hobbs. J. Hyg., 61: 515-29(Dec. 1963).

Studies on the use of γ radiation for the elimination of salmonellae from whole eggs, frozen horse meat, desiccated coconut, and bone meal show the extent to which the nature of the medium influences the resistance of these organisms to γ radiation. There is also a variation in radiation resistance between different serotypes; S. typhimurium was consistently the most resistant of those examined. On the basis of experiments with artificially inoculated or naturally contaminated products, and also on dose/survival curve

data, the dose requirement for the elimination of salmonellae from frozen whole egg is estimated at 0.5 Mrad, which gives a 10^7 reduction in numbers of S. typhimurium; for frozen horsemeat 0.65 Mrad, giving a 10^5 reduction; and for bone meal between 0.5 and 0.75 Mrad, giving between 10^5 and 10^8 reduction. A dose of 0.45 Mrad appears effective for desiccated coconut, with a reduction of 10^3, but such a radiation dose affects the quality of this product. (auth)

15855 ANTI-BOVINE SERUM ALBUMIN FORMATION BY TRANSFERRED HYPERIMMUNE MOUSE SPLEEN CELLS. Raymond Mark and Frank J. Dixon (Scripps Clinic and Research Foundation, La Jolla, Calif.). J. Immunol., 91: 614-20(Nov. 1963).

Antibody formation by transferred hyperimmune spleen cells was studied using bovine serum albumin as antigen and inbred mice as donors and recipients. It was shown that isologous adult and neonatal hosts support antibody formation by transferred cells. The amount of antibody formed in neonatal hosts was less than that in adult recipients. Antibody was not formed in homologous adult or newborn recipients, and this is most likely because of rejection of the transferred cells prior to their formation of antibody. The host-vs-graft reaction could be suppressed by prior x irradiation of recipients with consequent antibody formation by transferred homologous cells. Further, if isologous recipients were irradiated prior to cell transfer, the antibody response was found to be greater than that in nonirradiated isologous hosts. Transferred cells appeared to survive in the isologous recipients for a prolonged period of time with continuing formation of antibody. It may be that after depletion of lymphoid tissue by radiation, there is a nonspecific stimulus for proliferation of lymphoid cells which affects both the remaining host lymphoid cells and the transferred cells. An additional possibility is that in conjunction with decreased competition from the host's own cells, the antigen stimulated anti-BSA producing cells, which are capable of more rapid division than unstimulated cells, are consequently able to occupy a greater proportion of the total lymphoid space than the unstimulated lymphoid cells. The lesser antibody response by transferred cells in isologous hosts with delay of restimulation suggests that the number of transferred cells capable of responding to antigen decreases with time after transfer. (BBB)

15856 ENHANCED ANTITOXIN RESPONSES IN IRRADIATED MICE ELICITED BY COMPLEXES OF TETANUS TOXOID AND SPECIFIC ANTIBODY. Richard D. Stoner and Geronimo Terres (Stanford Univ., Calif.). J. Immunol., 91: 761-70(Dec. 1963) (BNL-7019)

Enhanced primary antitoxin responses were obtained in mice immunized by intravenous injection with complexes of tetanus toxoid and mouse antitoxin, presumably formed either in vivo, or prepared in vitro in antigen-antibody ratios of antibody excess, equivalence, and antigen excess. The demonstration of the enhancement phenomenon elicited by complexes of toxoid and isologous mouse antitoxin provide conclusive evidence that the antibody portion of the complex does not need to be of heterologous origin in order to elicit enhanced primary antibody responses in mice. Intravenous immunization with the above complexes elicited enhanced primary responses in irradiated animals, whereas minimal responses were obtained with antigen only. Little difference was observed in primary responses in nonirradiated mice when antigen only or antigen complexed with specific antibody is given by subcutaneous injection. However, enhanced primary antitoxin responses were obtained in irradiated mice (400 rad) immunized with the various complexes over the responses observed in irradiated animals immunized with antigen only. The greatest degree of enhancement occurred when the complexes were prepared in the region of equivalence and antigen excess. Secondary antitoxin responses were repressed when the same complexes of antigen and antibody were injected to elicit secondary responses. A corresponding repression of secondary responses was observed in irradiated mice when radiation doses of 300 rad were delivered 24 hr before the second injection of antigen complexed with specific mouse antitoxin. (BBB)

15857 THE EFFECT OF X-IRRADIATION AND PASSIVE ANTIBODY ON IMMUNOLOGIC TOLERANCE IN THE RABBIT TO BOVINE SERUM ALBUMIN. William O. Weigle (Scripps Clinic and Research Foundation, La Jolla, Calif.). J. Immunol., 92: 113-17(Jan. 1964).

Immunologic tolerance to bovine serum albumin (BSA) induced in rabbits by neonatal injection of BSA was not terminated following whole-body x irradiation. Some of the rabbits received passive anti-BSA prior to x irradiation in order to remove any persisting BSA, since the presence of the antigen during the recovery period might have prolonged the tolerant state. Other investigators have been able to demonstrate a termination of partial tolerance to heterologous erythrocytes in rats, BSA in rats, and homografts in mice. However, since the state of tolerance in these situations had been only partial, the animals undoubtedly contained some cells that were capable of responding to the tolerated antigen. Thus, the effect of x irradiation on the partially tolerant state may be similar to the enhancing effect that x irradiation has on the immune response in normal animals receiving the antigen prior to x irradiation. In this situation, the cells surviving x irradiation which were stimulated by prior injection of antigen appeared to multiply more rapidly than the nonstimulated cells; and, therefore, they disproportionately repopulated the partially tolerant state, stimulated nontolerant cells which survive x irradiation and may multiply more rapidly than the other surviving cells, and also disproportionately repopulate the depleted lymphoid tissue. An appropriate increase in the number of responsive cells would result in a responsive rather than a tolerant state. Since BSA tolerance in the rabbit is a completely tolerant state, stimulated cells would not exist after x irradiation and the depleted lymphoid tissue would be repopulated with cells incapable of responding to BSA. The tolerant state of BSA-tolerant rabbits was not terminated by passive anti-BSA. The injection of anti-BSA, followed 2 days later by an injection of excess I^{131}-labeled BSA, did not result in an immune response as evidenced by failure of the rabbits to show an immune elimination of the I^{131}-labeled BSA, whereas this same procedure resulted in an enhanced immune response in normal rabbits. Similarly, injection of large amounts of normal rabbit serum into BSA-tolerant rabbits failed to induce an immune response to a subsequent injection of BSA. These results are not compatible with Jerne's theory of antibody production, which postulates that natural antibody reacts with the antigen and transports it to the specific cells capable of producing antibody to that antigen. (BBB)

15858 MODIFICATION OF ANTHRAX BY IONIZING RADIATION. Charles C. Berdjis, William S. Gochenour, Jr., and Joshua E. Henderson (Fort Detrick, Frederick, Md.). J. Infect. Diseases, 113: 219-27(Nov.-Dec. 1963).

Since dogs are not susceptible to anthrax when inoculated cutaneously, the possible effect of irradiation on susceptibility was explored. Beagles received x irradiation

combined with anthrax either simultaneously or three days after irradiation. The controls were irradiated or infected with anthrax alone. A single dose of 125, 250, or 325 r total-body 1-Mev x irradiation was used, which was either equal to or less than the LD_{50} for dogs. A dose rate of 68 r/min in air was used. The distal ½ of the femur and the tibia of both hind legs of some dogs in the 250-r group were shielded from radiation. Spores of Bacillus anthracis which had been heat-shocked 48 hr earlier were injected in two doses (5×10^4 or 1×10^6 spores) by the subcutaneous route into the right axilla either simultaneously with or three days after irradiation. Regardless of dose, anthrax alone did not kill dogs. Irradiation alone killed three of six animals in the 250-r group, two of two in the 325-r group, and none in the 125-r group. The dogs died with the acute radiation syndrome characterized by severe lymphohematopoietic depletion and multiple visceral hemorrhages or manifestations of a hemorrhage diathesis. Lymphopenia was observed. Shielding of hind legs protected the irradiated animals from death. Anthrax combined with irradiation killed most of the dogs, inoculated with either high or low doses of anthrax, between 6 and 12 days after infection regardless of dose and time of irradiation. Shielding of the hind legs of irradiated anthrax-infected dogs did not fully protect the dogs from death; four of seven animals in this group died. In contradistinction to the controls, irradiated anthrax-infected dogs invariably developed septicemia with concomitant diffuse and massive cellulitis and a peculiar histopathologic reaction. The histopathologic reaction was essentially hemorrhagic, poor in inflammatory cells, and exceptionally rich in bacilli and bacterial thrombi. This reaction was not observed in other species injected with anthrax. Thus, the normal resistance of the dog to anthrax was markedly reduced by irradiation. Irradiation may increase the harmful effect of anthrax by disturbing the mechanism of defense in this resistant host. This is probably due to damage to the lymphatic and hematopoietic systems by irradiation, further complicated by the infection. Therefore, this combination seems to create a favorable medium for anthrax spores to germinate and multiply. It seemed to stimulate the germination with rapid dissemination and overwhelming septicemia. This was confirmed by the fact that no bacteremia nor significant, persistent cellulitis was observed in the dogs infected with anthrax alone, while irradiated anthrax-infected dogs died with massive, overwhelming septicemia and extensive cellulitis. (BBB)

15859 RADIATION PATHOLOGY. Harold E. Resinger (Good Samaritan Hospital, Lexington, Ky.). J. Iowa State Med. Soc., 52: 404-6(July 1962).

The effects of the explosion of an atomic or hydrogen weapon are discussed in terms of broad categories, the direct and the indirect effects. The direct effects include injuries to the body caused by the sudden changes in atmospheric pressure, flash burns due to the intense heat produced at the instant of detonation, and subsequent exposure to ionizing radiation. It is pointed out that, contrary to what is generally believed, direct injuries from the blast itself are slight as compared with those produced by conventional high explosives. Secondary effects of the atomic explosion probably account for more deaths than the primary effects. It is suggested that the biologic alteration is of a chemical rather than a physical nature, and that the location of damage is not nearly so specific as formerly thought. Basic radiobiologic reactions are discussed and the effectiveness of chemical radioprotectants considered. Various prophylactic and therapeutic measures which might be of value to civilian populations exposed to radiations from thermonuclear explosions are outlined. (BBB)

15860 IRRADIATION OSTEOMYELITIS OF THE JAWS. William S. Dodson. J. Oral Surg., 20: 467-74 (Nov. 1962).

Irradiation osteomyelitis of the jaws, a chronic infection of the maxilla or mandible after irradiation therapy for cancer of the oral cavity, is a major complication of irradiation therapy. Its etiology, pathology, and treatment are described with reference to 10 cases occurring among 108 irradiated patients. The three primary etiological factors of irradiation osteomyelitis of the jaws are irradiation, infection, and trauma. Irradiation osteomyelitis of the jaws may be initiated by any one of these three factors or by any combination of the three. Its incidence increases considerably as the total roentgen dosage exceeds 5,000 r. Infection is always present in irradiation osteomyelitis of the jaws. The two primary avenues of bacterial invasion to the maxilla and mandible are by direct communication of the alveolar bone with the oral flora, and by way of badly broken down teeth. A denture may serve as a source of trauma and should never be utilized over irradiated alveolar bone. Irradiation osteomyelitis developed in 10 of 108 patients who received irradiation therapy for cancer of the oral cavity. In this series, nine had the condition in the mandible as compared to one in the maxilla. Irradiation osteomyelitis is more frequent about the mandible because of its poorer blood supply, and because the mandible is within the direct line of irradiation far more frequently than is the maxilla. Pain was a universal symptom, and acute infection was associated with the intensity of the pain. As the acute infection responded to therapy, the intensity of the pain diminished. The presence of denuded bone about the area of irradiation osteomyelitis was a universal clinical finding. Average interval between the completion of irradiation therapy and onset of irradiation osteomyelitis was 13 months. The shortest was six weeks and the longest 21 months. The total x-ray dosage received by the 10 patients ranged from 5000 to 9950 r, with an average of 6375 r. Irradiation was also administered by insertion of Ra needles in three of the 10 patients, and the incidence of irradiation osteomyelitis was greater when this technic is utilized. Nonnarcotic analgesics were utilized for control of pain, but surgical intervention was considered for those patients requiring continuous narcotics. Nerve blocks with absolute alcohol were beneficial but failed to provide permanent relief of pain. Segmental resection or hemimandibulectomy was carried out in patients in whom irradiation osteomyelitis involved a large segment of the mandible. Resection of the maxilla was not done in treatment of irradiation osteomyelitis of the maxilla since the margins are never free of irradiated bone. (BBB)

15861 EFFECT OF DEUTERIUM OXIDE ON THE GROWTH OF PEPPERMINT (MENTHA PIPERITA L.). I. MORPHOLOGICAL STUDY. M. I. Blake, F. A. Crane, R. A. Uphaus, and J. J. Katz (Univ. of Illinois, Chicago). J. Pharm. Sci., 53: 79-83(Jan. 1964).

A study was made of the effects of extensive replacement of H by D on the growth of a higher plant. The effect of varying concentrations of D_2O on the growth of mint plants was determined for a period of 50 days, at which time the control plants initiated inflorescences. The extent of D uptake by the plant, as determined by direct analysis, is also reported. With the exception of the 20% level, increasing concentrations of D_2O in the nutrient solution caused a nearly proportionate reduction of elongation growth of the axial shoot. This pattern of elongation was reflected in the absorption of nutrient solution by the roots. The volumes necessary to replenish or replace that taken

up for growth or transpiration by the plants were progressively less for increasing D_2O levels. At low D_2O concentrations (10 to 40%), the lateral stems grew more nearly like short-day lateral stems. The lateral stems hung recumbent and were elongated more than the corresponding erect lateral branches of the controls. There was a greater reduction in shoot length and greater retardation of leaf development with increase in D_2O concentration. Lateral shoots of the 70% D_2O plants were so short that after 50 days of growth they were still difficult to measure. They were overlapped by primary leaves of the main shoot. These growth responses are probably due to the inability of the plants to synthesize adequately their structural, storage, and hormonal materials required for normal growth. Reduction in elongation of leaf blades and petioles followed the same general pattern as that of the stems. The leaves of plants in 80% D_2O nutrient did not elongate more than a few millimeters, remained epinastic throughout their existence, and eventually became necrotic, brown, and dry. The root system reflected to a lesser degree the same pattern of response to D_2O. The ability of plants growing on any concentration of D_2O initiate inflorescence was impaired. The effect of D_2O on cellular activity was rapid and drastic at high concentrations. Young rooted cuttings placed in 99.6% D_2O nutrient solution developed brown areas along the midrib of the basal half of all expanded leaves. A comparison was made between the D content of water distilled from deep-frozen fresh plants and water of combustion of dried plants. The distilled or labile water contains D from water loosely bound by the plant tissues and represents essentially completely exchangeable D. The deuterium content of the labile water from the plant was about 75% that of the nutrient solution in which the plant was grown. The water obtained from combustion of the dried plants, representing organically bound exchangeable and nonexchangeable D, contained about 50% of the D content of the nutrient solution. The ratio of organically bound to labile D was about 0.66. (BBB)

15862 ELECTRON MICROSCOPIC OBSERVATIONS IN RADIATION NEPHRITIS. Seymour Rosen, Martin A. Swerdlow, Robert C. Muehricke, and Conrad L. Pirani (Univ. of Illinois, Chicago). Lab. Invest., 12: 851(Aug. 1963).

Light and electron microscopic observations were made on a renal biopsy and subsequent autopsy of a 40-yr-old woman with radiation nephritis. The patient received more than 3000 r to each kidney over a period of 8 weeks during therapy for ovarian carcinoma. Five months after treatment the patient became edematous and the diagnosis of nephrotic syndrome was made. Renal biopsy was performed at that time. The patient died in uremia 2 months later. The character of the glomerular changes in radiation nephritis was clarified by electron microscopic observations. The endothelial cells were markedly swollen, vacuolated, and contained osmiophilic droplets. The basement membrane was well maintained on its epithelial aspect, but on the endothelial side blended with large quantities of spongy, lamina densa-like material. This material was often arranged in a trabecular pattern surrounding endothelial or axial cell cytoplasm and occasionally erythrocytes. The epithelial cells were vacuolated, contained osmiophilic droplets, and showed focal fusion of foot processes. In the tubules, evidence of regeneration and basement membrane thickening was noted. In both glomerular and tubular cells, nuclear and mitochondrial abnormalities were frequently seen. Retrospective studies of autopsy cases and review of the literature suggest that in radiation nephritis the glomerular component is more important than previously suggested and constitutes a characteristic feature of this disease, both by light and electron microscopy. (BBB)

15863 OBSERVATIONS OF THE EARLY EFFECTS OF X-IRRADIATION ON THE SPLEEN IN THE RAT. W. A. Bari and G. D. Sorenson (Washington Univ., St. Louis). Lab. Invest., 12: 856(Aug. 1963).

Adult rats were given 600 r of whole-body irradiation and killed at intervals of 30 min to 10 hr from the midpoint of the irradiation period. Injections of H^3-labeled thymidine were made 2 hr before sacrifice. Splenic tissue was processed by the usual methods for light microscopy, autoradiography, and electron microscopy. By electron microscopy, nuclear damage was observed as early as 75 min after irradiation. Peripheral parts of the nuclei appeared more electron-dense than normal, whereas the central areas were more electron-lucent. At other times one side of the nucleus appeared to be much denser than the other. Diminished uptake of H^3-labeled thymidine was also observed by this time. Mitochondrial alterations were also noted as early as 75 min after irradiation. Small, well-defined electron-lucent vacuoles appeared between mitochondrial cristae and distorted them. Generalized swelling of mitochondria was also observed. Phagocytic activity was increased 4 hr after irradiation. Macrophages contained many damaged lymphocytes which underwent further disintegration. Erythrocytes were also seen inside macrophages, associated with ferritin which was probably derived from the engulfed erythrocytes. The destruction of lymphocytes was progressive and at 10 hr after irradiation there was complete loss of lymphoid cells and only the reticular cells remained. This study demonstrated well-defined ultrastructural damage within lymphocytes as early as 75 min after irradiation, which may be related to enzymatic changes within the lymphocyte at that time. There was a derangement in the uptake of thymidine which would indicate decreased DNA synthesis at this early interval. (BBB)

15864 SUBCELLULAR EFFECTS OF X-IRRADIATION. P. O'B. Montgomery, R. C. Reynolds, and David H. Karney (Univ. of Texas, Dallas). Lab. Invest., 12: 858(Aug. 1963).

Many cellular effects, both lethal and sublethal, of x irradiation have been reported in the literature. These effects have dealt primarily with alterations in the genetic apparatus or of effects on cells in multi-cellular systems. This report is concerned with the less dramatic, although not necessarily less important, subcellular and cellular manifestations of x irradiation in vivo. Liver cells were prepared in tissue culture chambers and subjected to 600 r of x radiation delivered by a 250-kv x-ray machine. After x irradiation the resulting subcellular and cellular effects were recorded by phase-contrast, time-lapse motion picture observations. At appropriate postirradiation intervals, cells were fixed for study by electron microscopy and histochemistry. A variety of subcellular responses to this amount of x irradiation was demonstrated by these techniques. Such responses in cell organelles included vesiculation and sequestration of the peripheral cytoplasmic membrane; mitochondrial enlargement, curling, and splitting; nuclear hypertrophy; nucleolar duplication; and a rearrangement of nucleolar components. In addition a variety of unusual abortive attempts at mitosis and recombination were seen. Examples of this included pseudoendomitosis, formation of micronuclei, and cytoplasmic fusion without nuclear fusion. (BBB)

15865 THE HIT THEORY. Janos Barany. Magy. Radiol., 14: 51-7(Jan. 1962). (In Hungarian)

The selective hit theory to explain radiological effects at the cellular level is discussed in detail and the research and interpretations of various authors are considered. The theory is refuted on several grounds. (BBB)

15866 A FAST PROTON SOURCE FOR RADIOBIOLOGY. G. J. Neary (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Nature, 201: 838-9(Feb. 22, 1964).

The use of the exoergic deuterium–helium-3 reaction for production of 14.7-Mev protons in an accelerator of modest energy permits the investigation of radiation effects on cells and microorganisms under much more controllable and precisely defined conditions of LET than is possible with fast neutrons and with an advantage of two orders of magnitude in available dose rate. Moreover, the dosimetry of the proton radiation is far simpler than for fast neutrons since only simple measurements of ionization in air are needed. The radiation dose to a specimen is far less influenced by the composition of the specimen and its surroundings than is the case with neutrons. The capital cost of producing 14.7-Mev protons in the manner indicated is at least an order of magnitude smaller than if direct acceleration were used. (auth)

15867 RADIATION INVESTIGATION OF NUCLEO-CYTOPLASMIC INTERRELATIONS IN MORPHOGENESIS AND BIOCHEMICAL DIFFERENTIATION. A. A. Neyfakh (Inst. of Animal Morphology, Academy of Sciences, Moscow). Nature, 201: 880-4(Feb. 29, 1964).

Results of investigations since 1959 on time dependence in nucleo-cytoplasmic interrelations during embryonic development are reviewed. Topics discussed are: radiation inactivation of nuclei as a method to determine nuclear activity periods in early animal development; nuclear function in different species; the role of the nuclei in metabolic differentiation; the role of the nuclei in changes of cytochrome c oxidase activity; and the role of nuclei in the increase of catepsin activity. (H.M.G.)

15868 RADIOMIMETIC ACTION OF POLYIMINE CHEMISTERILANTS IN NEUROSPORA. A. R. Kaney and K. C. Atwood (Univ. of Illinois, Urbana). Nature, 201: 1006-8(Mar. 7, 1964).

The toxicity and mutagenicity of 2,2,4,4,6,6-hexa (1-aziridinyl)-2,4,6-triphospho-1,3,5-triazine (Apholate), tris (1-aziridinyl) phosphine oxide (APO), and tris (1-(2 methyl) aziridinyl) phosphine oxide (MAPO) was tested in a system that permits a distinction between nuclear and other cytotoxid effects; heterokaryotic conidia of Neurospora crassa. Fifteen minute exposures to unbuffered 0.5% solutions of the three compounds gave surviving fractions in the neighborhood of 0.1 on minimal medium, corresponding to a dose of about 50,000 r of x rays. It was concluded that the compounds are mutagenic for Neurospora. (P.C.H.)

15869 TIME OF ACTION OF THE THYMUS IN THE IRRADIATED ADULT MOUSE. A. Marjorie Cross, A. J. S. Davies, Barbara Doe, and Elizabeth Leuchars (Royal Cancer Hospital, London). Nature, 201: 1045-6(Mar. 7, 1964).

Studies were made on the humoral factor in thymic function and on the time of action of the thymus in the restoration of immunological competence after irradiation. CBA male mice of an inbred strain received 850 r whole-body x irradiation that was followed in 3–4 hr by an intravenous injection of 5×10^6 cells of syngenetic bone marrow at 10–12 weeks of age. Total thymectomy was performed either 8–10 days before or 13 days after irradiation. Thymus grafts were implanted to a subcutaneous site half-way along the right flank of the mice on the seventh day after irradiation. The results indicated that thymectomy 13 days after irradiation considerably impairs the recovery of the immunological mechanism. In mice thymectomized before irradiation and bone marrow therapy, the results suggest that a thymus graft effects some restoration of immunological competence even though present for only 12 days. The inference from both experiments is that, however the thymus facilitates restoration of immunological competence in irradiated animals, it commences to do so within at least 7–8 days of its period of maximum aplasia following either irradiation or grafting. (P.C.H.)

15870 BIOLOGICAL EFFICIENCY OF P^{32} TRANSMUTATION IN DIPLOID SACCHAROMYCES CEREVISIAE. Jaroslav Drobnik (Charles Univ., Prague). Radiation Res., 21: 339-54(Mar. 1964).

The killing curves of diploid Saccharomyces cerevisiae AER and aer after uv and β irradiation and after ^{32}P transmutation were estimated. The influence of various culture conditions was studied. Comparing the energy transferred to whole cells, it was concluded that ^{32}P transmutation is 2500 to 5000 times as efficient as uv, and 20 to 100 times as efficient as β irradiation. If only the energy given to DNA is taken, ^{32}P transmutation is only five times as efficient as β irradiation. The respiratory-deficient mutant is more sensitive than the original strain. The tail component is present in the killing curves. Some problems concerning the mechanism of ^{32}P suicide and the possible role of subionizing excitations are discussed. (auth)

15871 EFFECT OF IRRADIATION ON THE ABILITY OF PSEUDOMONAS TO SYNTHESIZE TWO INDUCIBLE ENZYMES. D. L. Dewey (Mount Vernon Hospital, Northwood, Middx, Eng.). Radiation Res., 21: 367-75(Mar. 1964).

An attempt was made to measure the relative radiosensitivity of the capacity of a Pseudomonas to form two inducible enzymes. On the assumption that the ability to form both enzymes would have nearly the same radiosensitivity, the concentration of L-histidine was measured, as this was the product of the first enzyme and the substrate of the second. The experiments revealed that the ability to produce histidine ammonia-lyase was several times as radiosensitive as that of histidine racemase. (auth)

15872 RADIOAUTOGRAPHIC STUDIES OF THE EFFECT OF IRRADIATION ON THE LONG-LIVED LYMPHOCYTE OF THE RAT. N. B. Everett, R. W. Caffrey, and W. O. Rieke (Univ. of Washington, Seattle). Radiation Res., 21: 383-93(Mar. 1964).

The long-lived small lymphocytes of the rat thoracic duct lymph, mesenteric lymph nodes, and spleen are very radiosensitive. Approximately 90% are destroyed by 300 r of total-body γ irradiation. The majority of small cells surviving this amount of irradiation show a postirradiation enlargement which is most pronounced at 10 to 11 days. The enlargement includes an increase in nuclear diameter and an extensive increase in cytoplasm. Evidence is presented to show that some of these enlarged small lymphocytes undergo division. Labeled small lymphocytes transfused into irradiated recipients show a similar enlargement. This suggests that the hypertrophy and subsequent division of small lymphocytes is a secondary effect of irradiation and is probably mediated through the irradiated animal. (auth)

15873 EFFECT OF X-RAYS ON MOVEMENTS OF SODIUM IN HUMAN ERYTHROCYTES. F. Bresciani, F. Auricchio, and C. Fiore (Università, Naples and Brookhaven National Lab., Upton, N. Y.). Radiation Res., 21: 394-412(Mar. 1964). (BNL-7020)

The effect of doses of x rays from 890 to 8900 rads on fluxes of Na ions in human erythrocytes in vitro was investigated. The active and passive fluxes of Na ions were differentiated by incubation of the cells in media containing or lacking K. This method is based on the established fact that in the absence of K in the external medium the active efflux of Na or Na pump is abolished, without other evident effect or damage to the cell. The Na pump was inhibited by x irradiation. The dose-effect curve of the K-dependent Na efflux can be analyzed by the following equation: $P = p_1 e^{-\lambda_1 d} + p_2 e^{-\lambda_2 d}$ where p_1 and p_2 are two components with different radiosensitivities; λ_1 and λ_2 are the constants of inactivation by x rays of p_1 and p_2; and d is the dose of x rays, in rads. The value of p_1 is about three-fifths of the flux with a $D_{37}^{p_1} \simeq 740$ rads; p_2 accounts for the remaining two-fifths of the flux and shows a $D_{37}^{p_2} \simeq 10{,}700$ rads. Therefore p_2 is about fifteen times as radioresistant as p_1. Further investigation is necessary to elucidate the meaning of the two components in which the K-dependent Na efflux can be analyzed. The portion of Na efflux which occurs despite the absence of K in the medium and the whole Na influx are passive fluxes. They are stimulated by x irradiation. In both cases the increase is a linear function of the dose in the range 890 to 8900 rads, although the per cent rate of increase is different: 10.2 to 10.7 $krad^{-1}$ for influx, and 6.3 $krad^{-1}$ for passive efflux. The results suggest that this stimulation of passive fluxes is due partly to increase in mobility of the hypothetical carriers for passive Na transport in the membrane, and partly to discontinuation of membrane integrity and leakage of Na. (auth)

15874 MITOTIC DELAY IN MORE MATURE ERYTHROBLASTS OF THE DOG, INDUCED IN VIVO BY SUBLETHAL DOSES OF X-RAYS. N. Odartchenko, H. Cottier, L. E. Feinendegen, and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). Radiation Res., 21: 413-22(Mar. 1964). (BNL-7159)

The early effects of a single whole-body dose of 150 r on the in vivo proliferation of bone marrow erythroblasts is examined by following the perturbations induced into the initial progression of a wave of tritiated thymidine labeled cells. It indicates the occurrence of a block in late preprophase; a subsequent entry into mitosis of delayed cells, which are the only cells in mitosis $4\frac{1}{2}$ hr after irradiation; and a generally moderate slowing down of the progression of irradiated erythroblasts through further maturation. (auth)

15875 STUDIES OF THE MORTALITY OF A-BOMB SURVIVORS. 2. MORTALITY IN SELECTIONS I AND II, 1950-1959. Seymour Jablon, Morihiro Ishida, and Gilbert W. Beebe (National Inst. of Health and Atomic Bomb Casualty Commission, Japan). Radiation Res., 21: 423-45(Mar. 1964).

The joint Japanese National Institute of Health–Atomic Bomb Casualty Commission (JNIH-ABCC) mortality study was based on a sample of about 100,000 persons consisting of survivors exposed within 2500 m of the hypocenter plus distally exposed and nonexposed comparison groups. The report was based on observation from October 1950 to September 1959 of the first two groups selected for the study, numbering more than 90,000 persons. Each person included in the study was the subject of field interview to obtain required background information and to determine eligibility. Total mortality rates are not grossly different as between survivors exposed at different distances, but nonexposed persons, particularly males, have much lower mortality rates than do exposed persons. In large measure this difference is attributable to much lower mortality from tuberculosis. It appears that, for the period 1950–1959, at least, selective mechanisms make the nonexposed an unsuitable comparison group. Leukemia mortality rates calculated from the present data confirm the well-known facts as to the leukemogenic effects of radiation from the atomic bombs on survivors. The results, on the whole, are not dissimilar from data previously published by ABCC investigators but do differ in some details, presumably as a result of diagnostic inaccuracies on the death notices. Mortality from malignant neoplasms other than leukemia differs in major ways from what would be expected from the analysis of the Hiroshima Tumor Registry by Harada and Ishida. Instead of a general increase of rather large magnitude in tumors of all sites among heavily irradiated survivors, an effect of moderate magnitude (though quite definite) is found among Hiroshima females. This effect is attributable almost entirely to increased frequencies of cancer of the stomach and of the uterus. No effect is seen in Hiroshima males or in either sex in Nagasaki. The effect seems not to be related to the existence of a history of symptoms of acute radiation injury. No interpretation of the finding is offered at this time. Definitely increased death rates for aplastic anemia were found, especially in Nagasaki, and attributed to diagnostic difficulties in distinguishing between this disease and leukemia. Mortality from tuberculosis was elevated among male survivors exposed within 1400 m in both cities, especially in Hiroshima. No explanation of this finding is presently available. There is a suggestion that both males and females aged 5 to 9 at observation may have suffered some excess mortality in the 1950–1959 period. (auth)

15876 EFFECT OF THYROPARATHYROIDECTOMY ON RADIATION-INDUCED CREATINURIA IN RATS. Samuel S. Kurohara and K. I. Altman (Univ. of Rochester, N. Y.). Radiation Res., 21: 473-80(Mar. 1964).

Thyroparathyroidectomized rats and sham-thyroparathyroidectomized rats were exposed to 500 r of whole-body x irradiation. Twenty-four-hour urine samples were collected for three days before exposure to x irradiation. Samples of blood from the tail veins were also collected at various time intervals. The degree of creatinuria was assessed by means of the daily urinary excretion of creatine. The results indicate that the thyroid gland affects radioinduced creatinuria at a whole-body exposure dose of 500 r only slightly but that certain differences, namely the negative correlation between the urinary creatine excretion and the erythrocyte creatine concentration and the depression of creatinine excretion on the first postexposure day, exist in the thyroparathyroidectomized group. The amount of creatine and creatinine excreted daily in both the thyroparathyroidectomized and sham-thyroparathyroidectomized rats is related to the amount of daily urinary volume. (auth)

15877 EFFECTS OF ROENTGEN IRRADIATION ON THE DYNAMICS OF EXPERIMENTAL PLEURAL EXUDATION. A. Abbati and R. Laschi (Università, Bologna). Radiobiol. Radioterap. Fis. Med., 18: 165-71(May-June 1963). (In Italian)

The effect of plesioroentgenirradiation on pleural in-

flammation induced by Croton oil in guinea pigs was studied. Exudation was constantly prevented by irradiation of the thorax performed in the 48 hours before the injection of the phlogogenic agent; such effect was temporary, in that beyond the 48 hours the irradiated guinea pigs reacted to Croton oil treatment in the same way as the unirradiated ones. The genesis of this phenomenon is discussed, taking into particular consideration the possibility of the occurrence of viscero-cutaneous reflexes. (auth)

15878 INCREASE AND RADIOSENSITIVITY OF WALKER TUMORS IN HIBERNATING RATS. A. Cavina Pratesi, G. R. Bandirali, and L. Mazza (Università, Pavia). Radiobiol. Radioterap. Fis. Med., 18: 172-86(May-June 1963). (In Italian)

The problem of the increase and radiosensitivity of Walker's tumor in hibernating rats was studied. It was observed that the development of the tumor in such conditions is slowed and that the decrease is even more marked in the case of animals subjected to radiation during hibernation. Despite the fact that under these experimental conditions changes in neoplastic cells are considerably less, it was concluded that the cancerostatic effects of hibernation and irradiation are diminished. (auth)

15879 INFLUENCE OF PAN IRRADIATION ON PLASMA CLEARING. B. Birarelli, L. Cenciotti, and A. Mariotti (Università, Parma, Italy). Radiobiol. Radioterap. Fis. Med., 18: 311-20(July-Aug. 1963). (In Italian)

Whole-body irradiation, in sub-lethal doses, caused, in the laboratory animals, equilibrium alterations of the liproproteic fractions of serum with displacement towards the fractions at higher Sf. At the basis of the alteration is a deficiency of the enzymatic system, known as "clearing factor", resulting from the x-ray injury. Candura and Mazzetti's spectrophotometric technique was used to determine the clearing factor in rabbits exposed to whole-body irradiation, in single doses of 800 and 400 r. In both experimental conditions a diminution of the rates of C.F. in comparison to unirradiated controls, proportional to the entity of the radiation dose given, was noticed. Some explicatory hypotheses of the phenomenon are advanced. (auth)

15880 HIGH OXYGEN TENSION AND RADIATION EFFECT ON THE KIDNEY. Joseph P. Concannon, Roy E. Summers, Ruth Brewer, Carrol Weil, and David Hayeslip (Allegheny General Hospital, Pittsburgh). Radiology, 82: 508-19(Mar. 1964).

Kidneys of dogs were irradiated under normal and increased oxygen tension at three different levels of radiation dose. A comparison of the effects of ionizing radiation on renal function was made among dogs in the two pressure groups and in the different radiation dose groups. Studies on glomerular filtration rate, effective renal blood flow, and maximum ability of the tubules to excrete p-aminohippurate (TmPAH) provide sensitive indices of radiation injury to the kidney, and in this investigation the changes in these renal functions were proportional to the dose of irradiation received by the kidneys. The major depression in renal function occurred within the first 10 weeks after irradiation, and the major morphological changes in the kidneys between the twentieth and the sixtieth weeks. No overall main effect of oxygen on the radiation response was noted. An overall radiation dose-oxygen pressure interaction was noted on all parameters of renal function studied. Radiation dose, increased oxygen tension, dose-pressure interaction, all may be factors in the 10 to 15% increase in kidney damage seen at the higher dose levels. (auth)

15881 CHANGES IN IMMUNITY REACTIONS DUE TO THE EFFECT OF IONIZING RAYS. IMPORTANCE OF DOSE AND MOMENT OF IRRADIATION. Dorin Petrescu, S. Schiau, I. Boros, Eugenia Chizari, D. Debau, and R. Stoenescu (Danielopolu Inst. of Normal and Pathological Physiology, Bucharest). Rumanian Med. Rev., 5: 225-31(1961).

Studies in whole-body x-irradiated rabbits showed that the formation of antibodies (anti-Proteus $X_{19}O$ agglutinins and anti-sheep hemolysins) is inhibited by irradiation performed two days prior to the primary immunizing injection (200 r) or 11 days prior to the secondary injection (150 and 300 r). This effect is proportional to the dose of irradiation. Irradiation with 200 r two days after the first immunization did not influence immunogenesis. Plasma protein levels (total protein or fractions) displayed no changes that might be ascribed to irradiation. The changes observed were related only to the time the antigens were injected and to repeated bleeding. The lack of any apparent changes related to irradiation may be on account of their being masked owing to simultaneous changes in opposite directions of the different protein fractions in plasma. Irradiation with 150 to 300 r does not alter blood complement levels in rabbits. Characteristic changes in the levels occurred only in relation to the appearance of antibodies, but the direction of these changes differs, depending on whether irradiation inhibits the immune response or fails to do so. The absence of changes in proteinemia, corresponding to these differences in immune reactions between rabbits irradiated during the radiosensitive phase and controls, was explained in the same manner as the complement changes, i.e., by the intervention of a regulation mechanism based on a physiochemical balance between the plasma and cellular concentrations of each protein fraction. It is also suggested that effects of radiation on antibodies and other plasma protein may be mediated via the adrenal cortex. (BBB)

15882 COSMIC RADIATION AND TUBERCULOSIS. V. INFLUENCE OF COSMIC RADIATION ON TUBERCULOSIS AT HIGH ALTITUDE (2,300m) AND AT SEA-LEVEL. S. G. Ong (Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, Peking). Sci. Sinica (Peking), 13: 241-58(Feb. 1964).

Tuberculous mice exposed to cosmic radiation at 2,300 m showed a significantly greater mean survival time and a significantly greater number of survivors than tuberculous mice exposed to cosmic radiation at sea-level. At high altitude as well as at sea-level the female showed a significantly greater mean survival than the male. The mean survival time of the male or female at high altitude is significantly greater than that of the male or female at sea-level. At high altitude there is no significant difference in mortality between male and female. At sea-level the female showed a significantly greater number of survivors than the male. The pooled data showed a significantly greater number of survivors of the female. At high altitude as well as at sea-level the lung lesions diminished, whereas the spleen lesions increased significantly with increasing survival time. (auth)

15883 COSMIC RADIATION AND TUBERCULOSIS. VI. IMMUNIZING PROPERTY OF TUBERCLE BACILLI EXPOSED TO COSMIC RADIATION. S. G. Ong (Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, Peking). Sci. Sinica (Peking), 13: 259-61(Feb. 1964).

Tubercle bacilli exposed to cosmic radiation, with 2.1, 7.4, and 9.5 cm of Pb, not only showed a strong attenuated virulence, but also possessed a strong immunizing prop-

erty against reinfection with virulent tubercle bacilli. The attenuation of the virulence and the immunizing property of tubercle bacilli placed under 9.5 cm of Pb are superior to those of tubercle bacilli placed under 2.1 and 7.4 cm of Pb. (C.E.S.)

15884 COSMIC RADIATION AND TUBERCULOSIS. VII. ACTION OF COSMIC RADIATION ON TUBERCLE BACILLI AT 2,300 m AND AT SEA-LEVEL. S. G. Ong (Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, Peking). Sci. Sinica (Peking), 13: 263-7(Feb. 1964).

Tubercle bacilli exposed to direct cosmic radiation for 104 days at 2300 m showed a significantly lower virulence than that kept in the laboratory or exposed to cosmic radiation at sea level. After reinoculation of the original culture there is a marked decrease of virulence. (C.E.S.)

15885 MICROBIAL SURVIVAL IN GAMMA-IRRADIATED SOILS. Ralph J. Hervey and Zelda M. Williams (Texas Agricultural Experiment Station, Temple). Texas Rept. Biol. Med., 21: 450(1963).

Irradiation was explored as an alternative method to heat sterilization, since autoclaved soils, employed as growth media for the Texas root-rot fungus, Phymatotrichum omnivorum, displayed low-level fungal toxicity and other undesirable chemical changes. Clay soils of widely differing physiochemical composition were irradiated with 874, 1747, and 2622 Mrad in glass containers, with soil arranged in continuous mass, or as concentric, glass-separated layer and inner core. Semiquantitative microbial survival indices were initially determined for actinomycetes, bacteria, fungi, heat-resistant aerobic microbes, and obligate anaerobes and enumerated on selected agar media. Irradiation affected major morphologic groups of micro-organisms as follows: with soils in continuous mass, all fungi were killed with 874,000 rad; with soils in glass-divided zones, 2,622,000 rad failed to kill all fungi. Although 2,622,000 rad consistently failed to kill all bacteria and actinomycetes, 874,000 rad destroyed the majority (99.6 to 99.9%). The kill rate leveled off markedly, above 874,000 rad, since medium- and high-dose irradiation destroyed only a few thousand additional cells. Clay and organic matter had little shielding effect on soil microbes; γ rays were as lethal to microbes in the center of the soil mass as to those in 8-mm peripheral layers. Some microbial subgroups were more radiation sensitive than the overall microbial population. Obligate anaerobes and gas producers on glucose were completely destroyed by 874,000 rad; heat-resistant aerobic bacteria and actinomycetes and bacterial utilizers of NH_4-NO_3-N were completely eliminated by 1,747,000 rad in some and 2,622,000 rad in other soils. Survivors, at dosages above 1,747,000 rad, required organic nitrogen, B vitamins, and soil factors. (BBB)

15886 THE EFFECTS OF ACUTE AND CHRONIC IRRADIATION ON THE RESPONSE OF THE DOG TO A HEMORRHAGIC STRESS. David H. Knott (Univ. of Tennessee, Memphis). Texas Rept. Biol. Med., 21: 459(1963).

Functional capacity of the cardiovascular system was studied in the irradiated dog. Dogs exposed to acute (500 r) and chronic (1 r/hr) doses of ionizing radiation were subsequently subjected to a standardized sublethal hemorrhagic stresss, consisting of a 100% bleed-out (bleeding volume) from a cannula in the femoral artery followed by the immediate re-infusion of a certain per cent of this bleeding volume. As an index of the volumetric and hemodynamic response to hemorrhage, the following parameters were determined: plasma and blood volumes, thiocyanate space, hematocrit, hemoglobin, cardiac output (dye-dilution technique), stroke volume, peripheral resistance, heart rate, blood pressure, and circulation time. In animals which were hemorrhaged on the fifth postirradiation day (500 r acute dose, x radiation) the volume of the vascular space was maintained more closely to normal after hemorrhage than that of the control group. However, the mean survival time of the irradiated group was significantly decreased. There was evidence also that another group of dogs hemorrhaged at 5 days postirradiation (500 r, acute) responded hemodynamically as well as, if not better than, the control group. (BBB)

15887 X-RADIATION MORTALITY IN HYPOTHERMIC RATS. Jonathan F. Decherd (Univ. of Texas, Galveston). Texas Rept. Biol. Med., 21: 464(1963).

When hypothermia was achieved by enclosing adult rats individually in sealed 1-qt Mason jars and placing them in a cold room (32°F), narcosis and hypothermia (rectal temperature 25°C) soon ensued. The control and treated rats were placed in a revolving Lucite, pie-shaped, motor-driven apparatus with an x-ray beam directed at the midpoint of the container from above. The animals were then given 640 r from an RCA therapy machine operated at 30 ma, 250 kv, and with a 0.25-mm Cu and 1-mm Al filter. Postirradiation individual body weight and mortality of both groups were monitored over a 30-day period. (BBB)

15888 RADIATION DAMAGE TO THORACIC TISSUES. A. G. W. Whitfield, W. H. Bond, and P. B. Kunkler (United Birmingham Hospitals, Birmingham, Eng.). Thorax, 18: 371-80(Dec. 1963).

Lesions in the chest developing after radiotherapy in 49 patients are described. Of all the thoracic tissues the lungs proved the most vulnerable to radiation damage. The risk is increased when large areas of lung are irradiated, the total dosage is high, and the course of treatment is given quickly. The 49 cases received irradiation of the thorax for breast cancer, malignant lymphomas, lung metastases, and esophageal and bronchial cancer. Seven of the 49 cases, all with severe bilateral damage, died from it. Thoracic irradiation caused in some cases constrictive pericarditis or was followed by transitory T wave changes in the electrocardiogram. The significance of the latter was uncertain. They were usually unassociated with cardiac symptoms or objective cardiac abnormality and disappeared within a year or less. Twelve of 27 patients studied showed such changes, and sudden death occurred in two. The most frequent manifestation of radiation damage to the bony structure of the thorax was fractured ribs. It usually followed postmastectomy radiotherapy. Other less common bony lesions attributable to radiation are described. Thoracic irradiation of females in childhood may result in mammary hypoplasia and absence of lactation. Radiation stricture of the esophagus was suspected in seven patients, but the diagnosis was disproved in each instance so this condition must be rare. The interval between the conclusion of x-ray treatment and development of symptoms attributable to radiation pneumonia varied from one to 16 weeks with a peak incidence at one month. Some people may be more sensitive to the harmful effects of radiation than others, but it was impossible to identify such subjects in advance of treatment. Age and arterial degenerative change did not appear to be relevant factors, but thin people seem more liable to radiation lung damage than those of greater body weight. Dominant influences in radiation lung damage were total dosage,

rate of administration, and the percentage of the total lung volume irradiated; the risk was reduced if treatment was protracted in time. Six patients, undergoing wide-field thoracic irradiation, were given prophylactic cortisone in a dose of 75 to 100 mg daily during and for three months after radiotherapy. Of these, one died from radiation lung damage while still taking 50 mg cortisone daily and another developed a small area of radiation pneumonia which cleared completely while taking a similar dose. Phenindione was given to eight patients in whom wide-field thoracic irradiation was necessary, but of these three developed radiation pneumonia and one died from radiation damage to the heart, indicating that this anticoagulant may not diminish pulmonary radiation injury. (BBB)

15889 HISTOPATHOLOGICAL STUDIES ON RADIATION PNEUMONITIS. Tsuneo Namiki (Tohoku Univ., Sendai). Tohoku J. Exptl. Med., 80: 89-102(June 25, 1963).

Postmortem findings in 25 patients who had received radiotherapy for cancers of the thoracic region are reported. The local x-ray or Co^{60} γ-ray doses varied up to 30,500 rad. Several other systems of classification of radiation pneumonitis were rejected and a new scheme is proposed which classifies this disease into four types from a pathologic standpoint according to the degree of damage to tissue components: alveolar exudative type (11 cases); interstitial proliferative type (2 cases); mixed type (5 cases); and fibroatelectatic type (7 cases). The alveolar exudative type is characterized by the exudation caused by irradiation and its organization, which occur in the alveoli. This finding is predominant, and edema, hyaline membrane formation, fibrin deposition, and intra-alveolar fibrosis are observed. In the interstitial proliferative type the major finding is fibrous thickening of the interstitial tissue including the alvelolar septa; the elastic fibers degenerate and rupture. The changes of alveolar epithelium are observed in both of these types, with proliferation and bizarre changes. In the mixed type these changes exist in the same specimen. These three types can be classified into three stages; i.e., early, middle, and late. The fibroatelectatic type represents a late stage; the lungs are atelectatic and abnormal proliferation of elastic fibers is observed in the alveolar wall which shows hyaline thickening. Macroscopically, this may be subdivided into localized and diffuse forms according to the extent of lesions. In the latter form, the whole lung becomes contracted to fist-size. Intra-alveolar edema was observed in 13 of 25 cases, frequently complicating in the early and middle stages. In seven of 25 cases, hyaline membrane formation was noted, mostly in the alveolar exudative type and only in cases with severe edema. Fibrin deposition occurred in 14 cases, mostly in alveolar exudative or mixed types. In the alveolar epithelium, regardless of the type of lesion, swelling and proliferation were both observed. Frequently, it assumed a bizarre form, the nuclei showing atypical forms and sometimes a multinuclear giant cell with two to three nuclei. The cytoplasm was darkly stained with eosin and was PAS-positive. Proliferating alveolar epithelium desquamated into the alveoli, and showed a tendency to fatty degeneration. In the late stage, a gland-like metaplasia with proliferation of alveolar epithelium was observed in six cases. Thickening of the alveolar septa was one of the most significant changes in radiation pneumonitis. Similar changes were seen in animal experiments with rats and rabbits. In these animals, however, marked changes could not be induced, which might be due to low sensitivity of endothelium of the alveolar capillary in comparison to the human. But in rabbits the same kind of changes as seen in human cases were noted in the alveolar septa in a few cases which received 10,000 r in divided doses (500 r, 20 times). This produced a marked change on the 140th day, and in an extensive area, fibrous thickening of the alveolar septa was observed, four to five times the normal thickness. In the human cases there was no difference in reactions between x-ray and Co^{60} irradiation. In the pathogenesis of this disease, the increase of capillary permeability of the alveolar wall seems to play the most important role. In addition to it, the lesion is characterized by abnormal metabolism of alveolar epithelium and new growth of connective tissue. The diagnostic criteria of this disease are discussed. (BBB)

15890 FURTHER STUDIES ON RHESUS MONKEYS IMMUNIZED AGAINST SCHISTOSOMA JAPONICUM BY ADMINISTRATION OF X-IRRADIATED CERCARIAE. H. F. Hsu, S. Y. Li Hsu, and J. W. Osborne (State Univ. of Iowa, Iowa City). Z. Tropenmed. Parasitol., 14: 402-12 (Oct. 1963).

In preliminary experiments performed on mice to determine the critical doses of x irradiation, mice were inoculated with irradiated Schistosoma japonicum cercariae which had been exposed to 2000, 10,000, 30,000, 45,000, and 60,000 r. Autopsy on the 35th day after inoculation showed the presence of immature worms in the group of mice which received 2000 r, but no worms in the other groups. In other mice inoculated with irradiated cercariae exposed to 500, 1200, and 1700 r, autopsy on the 35th day after inoculation showed that in the 500-r group, mature worms and eggs were found. In the 1200-r group, male worms with testes and female worms with ovaries but without eggs were found. In the 1700-r group one mouse harbored one male worm with testes, but 13 others had only immature worms. In the 3rd series, mice were infected with 50 male and 50 female cercariae exposed to 1700 r. More male than female worms were recovered, although equal numbers had been inoculated; furthermore, 83.6% of male worms had developed testes but only 8.7% of female worms possessed ovaries. Apparently, x irradiation is more harmful to the development of female than male worms. Fourteen monkeys were immunized with x irradiated cercariae before being challenged. The doses of 250-kv x rays varied from 1700 to 4000 r and the number of immunizing inoculations was either 3 or 4 at intervals from 27 to 106 days. The mean number of eggs/g of stool per day during the first 30 days in the immunized monkeys varied from 0 to 924 and in nonimmunized from 1220 to 46,036. The number of normal adult female worms recovered from immunzied monkeys varied from 0 to 43 and and in nonimmunized from 131 to 156. Generally, inoculations of monkeys with irradiated cercariae of the human strain of S. japonicum gave marked protection against a subsequent challenge with the homologous strain. Cercariae exposed to 1700 to 3000 r were almost equally effective in producing an immunizing effect, while those exposed to 3500 to 4000 r were somewhat less effective. The effect of 1700 r on cercarial sterility was not completely predictable, and 2000 r did not leave a good margin of safety. Therefore, for vaccination, S. japonicum cercariae should be irradiated with 2500 or 3000 r. Three or 4 inoculations were equally effective in producing resistance. The results showed that in the immunized rhesus monkeys both eggs and worms of the challenge infection of S. japonicum are substantially reduced in number due to the induced immunity of the irradiated cercariae. The effects of the immunization seemed to vary with the dose of x irradiation to cercariae, number of immunizing inoculations,

number of immunizing cercariae, time interval between immunizing inoculations, and the time of challenge. It is suggested that with the proper adjustment of these factors, a state of absolute resistance to the challenge infection of S. japonicum in rhesus monkeys may be reached. This goal is believed to be reasonable and proper even though the immune effect produced by giving irradiated cercariae of S. mansoni to mice is at variance in certain respects with some of these results. (BBB)

15891 SOME EFFECTS OF X-IRRADIATION ON THE DEVELOPMENT OF INBRED AND HYBRID MOUSE EMBRYOS. Charles P. Dagg (Roscoe B. Jackson Memorial Lab., Bar Harbor, Maine). p.91-102 of "Proceedings of an International Symposium on the Effects of Ionizing Radiation, in the Reproductive System." New York, Pergamon Press, 1963.

Female mice of three different strains were mated with normal males. Pregnant females were x-irradiated at 10, $10\frac{1}{2}$, and 11 days post-conception. Experimental and control mice were killed at 18 days post-conception and the uteri were opened. The fetuses were recorded as being alive, dead, or resorbed, and the live fetuses were examined for gross external malformations. In general it was shown that after x-irradiation at 11 days post-conception the same general types of abnormalities were produced in each strain; for particular malformations a given evidence of deformed embryos can be caused by lower doses in one strain; relative frequences of different abnormalities at a given dose rate are not the same, and the frequency with which a specific malformation is produced may not be correlated with the spontaneous occurrence of the same malformation in untreated animals. Proportions of cleft palates and malformed hind feet were studied in mice irradiated at 10 and $10\frac{1}{2}$ days post-conception. (H.M.G.)

15892 LONG-TERM EFFECTS OF IRRADIATION ON SPERM PRODUCTION OF DOGS. George W. Casarett (Univ. of Rochester, N. Y.). p.137-46 of "Proceedings of an International Symposium on the Effects of Ionizing Radiation, in the Reproductive System." New York, Pergamon Press, 1963.

Male beagles were given various x-radiation doses either chronically throughout life or in limited doses given singly and in fractions. Semen analysis was performed on a monthly basis. In dogs given daily doses accumulating to 0.3 r/week only two of the 20 become aspermatic, as did two of the ten dogs in the 0.6-r/week group. However, marked radiation effects were seen in the 3.0-r/week group. In the ancillary experiments the beginning of sperm count depression was seen about 10 weeks after irradiation, or, in the case of protracted doses, 10 weeks after the beginning of irradiation. Depression of sperm count was less in dogs receiving single exposure and recovery of this group was more complete. (H.M.G.)

15893 THE OCCURRENCE OF CHROMOSOMAL ABERRATIONS IN PRE-SPERMATOCYTIC CELLS OF IRRADIATED MALE MICE. II. CYTOLOGICAL STUDIES OF STERILE AND SEMI-STERILE F_1 INDIVIDUALS. A. B. Griffen (Roscoe B. Jackson Memorial Lab., Bar Harbor, Maine). p.175-88 of "Proceedings of an International Symposium on the Effects of Ionizing Radiation, in the Reproductive System." New York, Pergamon Press, 1963.

Progress made in a project seeking to determine whether aberrant offspring continue to be produced throughout the reproductive life of an irradiated male parent is reported. Three groups of male mice were given testicular irradiation doses of 350, 700, and 1000 r after which they were mated with normal females. All F_1 individuals were test-mated. Using a litter size of six or more as normal, any test animal producing a litter of five or less was considered to be semi-sterile. Semi-sterile F_1 mice were 4.9% for 350 r, 5.9% for 700 r, and 5.6% for 1000 r. No semi-sterile F_1 individuals were produced by the controls. Another set of male mice was irradiated and mated to normal females. Males among the F_1 progeny were sacrificed and slides were prepared from seminiferous tubules. Photomicrographs illustrate radioinduced abnormalities. (H.M.G.)

15894 PLACENTAL DYSFUNCTION AS THE CAUSE OF PRENATAL RADIATION DEATH: AN ENDOCRINE ORIENTED HYPOTHESIS. Stanley R. Glasser (Univ. of Rochester, N. Y.). p.361-76 of "Proceedings of an International Symposium on the Effects of Ionizing Radiation, in the Reproductive System." New York, Pergamon Press, 1963.

Studies were designed to evaluate the contribution of the maternal organism per se to prenatal radiation death, and to delineate its role in the interactions between zygote and uterine endometrium in the irradiated animal. Female Wistar rats were castrated and exposed to 500 r whole-body x rays $\frac{1}{2}$, $2\frac{1}{2}$, and $4\frac{1}{2}$ days after presumptive time of ovulation. Traumatized cornua were approximately 400 and 470% larger on days 7 and 9 postcastration than were their respective control horns. The simulated maternal placental tissue was characterized by a significant imbibition of water with a resultant dilution of protein. There was also a significant increase in uterine glycogen in the traumatized horn. Natural pregnancy was studied to determine whether the nature of the maternal placenta growth in irradiated animals is such as would limit the progress of implantation and trophoblast invasion. Hence, pregnant female rats were exposed to either 0, 125, 250, or 500 r whole-body x rays at either $\frac{1}{2}$, $2\frac{1}{2}$, or $4\frac{1}{2}$ days after conception. Considering data from animals given 250-r doses, it is concluded that a major cause of pregnancy wastage is due to placental dysfunction. (H.M.G.)

Radiation Effects Therapy and Countermeasures

15895 (NP-13730) GLYCIDIC ESTERS AND/OR ORGANIC DISULFIDES, AND RELATED SUBSTANCES, AS SOURCES OF ANTI-RADIATION DRUGS. Interim Research Report No. 17, October 1, 1963–December 31, 1963. J. D. Buckman, H. K. Kim, W. B. Lacefield, T. F. Parsons, and L. Field (Vanderbilt Univ., Nashville). Contract DA-49-193-MD-2030. 24p.

Progress is reported in the synthesis of disulfide compounds for testing as anti-radiation drugs. The preparation of analogs of o-aminoethyldithiobenzoic acid, mercaptodisulfides and related substances, dithiosulfites, and thiosulfonates is discussed. Factors bearing on the disproportionation of mixed disulfides were evaluated using 2-aminoethyl phenyl disulfide hydrochloride as a model. (C.H.)

15896 (JPRS-23834) ANTIRADIATION PROPERTIES OF GALLATES. A. A. Gorodetskii (Gorodetskiy) and V. A. Baraboy. Translation of p.5-12; 41-86; 125-6 from "Protivolucheve Svoistva Gallatov," Kiev, 1963. 64p. (OTS-64-21875)

A comprehensive study of gallic acid derivatives led to the conclusion that they are effective radioprotective com-

pounds. Data are summarized from studies on the toxicological, pharmacological, and radioprotective effects of gallates when administered before and immediately after exposure of laboratory animals to lethal doses of radiation. (C.H.)

15897 RADIOSENSITIVITY AND SH COMPOUNDS IN MAMMALIAN CELLS. Y. Ueno, M. Horikawa, T. Aoyama, and T. Sugahara (Kyoto Univ.). Folia Biol. (Prague), 10: 39-44(1964).

The correlation between the radiosensitivity and the contents of sulfhydryl and disulfide groups (SH compounds) as determined by polarography was studied in mammalian cells with different radiosensitivity in four comparative cases in vitro and in vivo. The content of low molecular SH compounds seemed to be larger in radioresistant cells than in radiosensitive ones except in the case of 5-bromodeoxyuridine sensitization in vitro. Thus the existence of natural radioprotective substances and their importance in determining the radiosensitivity of mammalian cells is supported in the present investigation. (auth)

15898 EFFECT OF 5-BROMODEOXYURIDINE ON THE EXPERIMENTALLY INDUCED RADIORESISTANCE OF ESCHERICHIA COLI. Luis V. Orce, Rita Lumi, Carlos Bobbi, and Dusan Kanazir (Comisión Nacional de Energia Atómica, Buenos Aires). J. Bacteriol., 87: 743-4(Mar. 1964).

Survival curves were established for Escherichia coli B/r (CSH). Cells were then inoculated into media containing 50, 100, 200, and 300 μg/ml of 5-bromodeoxyuridine (5-BUDR). Treatment with increasing amounts of 5-BUDR was followed by a decrease in radioresistance. A second series of cultures was supplemented with 100 μg/ml of 5-BUDR during log phase. A decrease in radioresistance proportional to the number of cell divisions in the presence of 5-BUDR was observed. (H.M.G.)

15899 ACTION OF ISOLOGOUS BONE MARROW FROM URETHAN-TREATED C57BL/6 MICE ON RADIATION LEUKEMOGENESIS. I. Berenblum, Louisa Boiato, L. Fiore-Donati, and N. Trainin (Weizmann Inst. of Science, Rehovoth, Israel). J. Natl. Cancer Inst., 32: 723-9(Mar. 1964).

Bone marrow cell suspensions from isologous mice pretreated with urethan were as effective in inhibiting radiation leukemogenesis in C57BL/6 mice as bone marrow from normal mice of the same strain. The results support earlier findings, by a different method of testing, from which it was concluded that the promoting effect of urethan in leukemogenesis did not depend on inactivation of the bone marrow. Females appeared to develop leukemia more readily than males in two groups of irradiated mice that were subsequently treated with bone marrow. The possible significance of this finding is discussed. (auth)

15900 INFLUENCE OF SUGARS ON THE RADIATION SENSITIVITY OF CATALASE. W. Lohmann, A. J. Moss, Jr., W. H. Perkins, and C. F. Fowler (Univ. of Arkansas, Fayetteville and Veterans Hospital, Little Rock, Ark.). J. Nucl. Med., 5: 213-15(Mar. 1964).

The change induced in the radiosensitivity of catalase by sucrose, fructose, and glucose was investigated spectrophotometrically. The x irradiation doses varied between 0 to 8.1×10^6 r. The radiation protective effect is considerably greater for fructose than for sucrose and glucose. Radiobiological implications are discussed. (auth)

15901 NITRIC OXIDE PROTECTION OF BACTERIOPHAGE AGAINST X-IRRADIATION DAMAGE. Irene M. Cotton, Robert R. Rinehart, Ruby Petrusek, and Wilson S. Stone (Univ. of Texas, Austin). Radiation Res., 21: 481-91(Mar. 1964).

The gas nitric oxide was found to protect the bacteriophage T_3r from damage due to x irradiation in dilute solution. The protection was at least equal to that found when the phage was suspended in nutrient broth. The idea that both the indirect effect and the aftereffect damage are due to radical formation in liquid media by the action of ionizing radiations is strengthened, since nitric oxide is known to be an excellent scavenger of radicals. Oxygen has little or no effect on this system. (auth)

15902 PREVENTIVE AND CURATIVE VITAMIN B_4 THERAPY OF POSTRADIOTHERAPEUTIC HEMATOLOGICAL COMPLICATIONS. A. Djian, H. Puchot, and R. Calop (Hopital Franco-Musulman, Paris). Semaine Hop. Paris, 38: 1958-9(June 8, 1962). (In French)

The antigranulocytic action of adenine (vitamin B_4), as a therapeutic agent in the prevention of postirradiation hematologic complications was studied. The patients chosen for this study, who received radiotherapy and protective adenine therapy at the same time, were of two types: those with rheumatic and other inflammatory diseases who had previously been exposed to radiation doses below 2000 r, and patients who had received massive localized radiotherapy for cancer and had suffered metastases or a recurrence of the primary tumor. The patients' hematologic condition was followed for 2 months to 2 yr. For the purpose of this study three groups of patients were studied: those receiving adenine therapy from the start, whose blood picture was essentially normal; those given adenine following the appearance of leukopenia; and a group of 20 controls receiving no adenine. The 26 patients receiving adenine from the start were exposed to doses of 2500 to 17,000 r over a period of 2 yr 8 months. Twenty-two of these presented a normal blood picture, but in four leukopenia had already developed. Adenine administration maintained the good blood picture in 21 of this group; in the remainder its protective action was manifest but incomplete. The 14 patients receiving vitamin therapy after the appearance of leukopenia were exposed to x-ray doses of 1500 to 22,800 r during periods of 3 months to 2 yr. In seven of the 14 the blood picture returned to normal before termination of radiation treatment, thus permitting uninterrupted radiation therapy. In the other seven there was sufficient improvement to permit continuation of radiotherapy without any evidence of adverse effects. Approximately 65% of the controls showed evidence of hematologic deficiencies. Adenine was administered via intramuscular or intravenous injection or infusion, or orally, in amounts of 90 to 180 mg/day. Tolerance to medication was good in all cases. Adenine is not toxic and is completely eliminated. There were no gastric or intestinal upsets, and no allergies reported. In those cases where the correction of leukopenia was not satisfactory, at the termination of irradiation, recovery was more rapid than is usual in irradiated cases. It was concluded that adenine is a useful protective agent for the maintenance of hematologic values, its use allowing more prolonged and high-dosage radiation treatment. (BBB)

15903 AUTOINFECTION (INTESTINAL) IN RADIATION SICKNESS AND ITS PREVENTION IN WHITE RATS OF THE WISTAR STRAIN. K. L. Kovalevskii. Tr. Inst. Genet., Akad. Nauk SSSR, No. 30, 315-30(1963).

Two groups of non-inbred white Wistar rats were given acidophilous milk with lactose orally ten days before and daily after x irradiation. The animals of group I (6 weeks old) received 8 ml acidophilous milk with 0.3 g lactose; those of group II (12 weeks old) received 10 ml acidophilous milk with 0.5 g lactose. The corresponding

controls (6 and 12 weeks old) received ordinary milk with 0.3 and 0.5 g lactose, respectively. Otherwise, the diet was the same for the test rats and for the controls. The rats were subjected to x irradiation with 700 r at 316 r/min (180 kv; 15 mamp; filter 0.5 mm Cu and 1 mm Al; focal length, 40 cm). The data obtained indicate that the daily administration of acidophilous milk with lactose added prevented the occurrence of diarrhea in irradiated rats, which was manifested in increased weight and decreased mortality. No pathological changes in the intestine were observed. (AID Press, Vol. 2: No. 179, March 1964)

15904 PROTIVOLUCHENYE SVOISTVA GALLATOV. (EKSPERIMENTAL'NOE ISSLEDOVANIE). (Anti-radiation Properties of Gallates. An Experimental Study). A. A. Gorodetskii and V. A. Baraboi. Kiev, Publishing House of Academy of the Sciences, 1963. 128p.

Contemporary concepts of radiation protection mechanisms are outlined. The protective effects of gallates against acute radiation sickness, the therapeutic effects of gallates, and the pharmacological properties of gallates are discussed. (C.E.S.)

Radiation Hazards and Protection

15905 (TID-7689(p.34-7)) MAXIMUM ALLOWABLE RADIOTRACER INJECTIONS FOR FLOW RATE MEASUREMENTS IN PUBLIC STREAMS. R. P. Gardner (Research Triangle Inst., Durham, N. C.).

Methods of estimating and measuring the maximum allowable concentrations of radioisotopes to be injected into public streams for flow rate measurements are discussed. The dilution and total-count methods are described. (M.C.G.)

15906 BREAD PRODUCTION WITH RADIOACTIVE CONTAMINATION OF RAW MATERIALS. H.-D. Ocker (Bundesforschungsanstalt fur Getreideverarbeitung, Detmold, Ger.). Brot. Gebaeck, 16: 212-16(Nov. 1962). (In German)

Protective precautions against radioactive fallout on food materials used for bread production are reviewed. Preventive measures such as dust screening and packing, appeared to be most promising. The decontamination of many concerned foods is either not possible or at this time still not investigated enough. Grain is freed, probably with a good prospect of success, from the dangerous radioisotopes ^{90}Sr and ^{137}Cs by precautionary milling methods, so that in times of urgency the provision of radiohygienically unobjectionable bread seems possible. (tr-auth)

15907 ESTIMATES OF $(MPC)_w$ FOR OCCUPATIONAL EXPOSURE TO Sr^{90}, Sr^{89} AND Sr^{85}. W. S. Snyder, M. J., Cook, and M. R. Ford (Oak Ridge National Lab., Tenn.). Health Phys., 10: 171-82(Mar. 1964).

Human data were used to obtain $(MPC)_w$ values for continuous occupational exposure to ^{90}Sr, ^{89}Sr, and ^{85}Sr. A three-exponential model is found to give an empirically adequate representation of the data on retention and excretion of strontium by grossly normal adults for a period of 200 days following intake. The third exponential is selected to be roughly consistent with the data on stable Sr in diet and in bone of adults, as well as in fair agreement with the estimates of bone turnover rates by Rowland. The use of a power function to describe retention is summarized. Also, MPC values are estimated for ^{90}Sr by the use of the observed ratio (O.R.), and from the diet-bone data on stable Sr. These various models are discussed briefly as to their adequacy for applied health physics. It is found that all these models indicate an $(MPC)_w$ for ^{90}Sr which is higher by a factor of 4 or more than that recommended currently by ICRP and NCRP. (auth)

15908 ON BIOLOGICAL FACTORS AFFECTING SECONDARY RADIATION PROTECTION STANDARDS. Y. Feige (Soreq Research Establishment, Atomic Energy Commission, Israel). Health Phys., 10: 204-5(Mar. 1964).

It is pointed out that organ weight, nutritional habits, daily water intake, and other biological factors must be considered when applying the radiation protection standards recommended by the ICRP to specific regional conditions. The total body weight and weights of important body organs for normal adult Indians are compared to the corresponding ICRP values for the Standard Man. Results indicate that local changes in maximum permissible body burden for a large number of radionuclides are justified. It is suggested that consideration also be given to the biological half life of radioisotopes in determinations of secondary radiation exposure. (C.H.)

15909 THE Sr^{90} CONTENTS OF SOILS AND PLANTS IN THE TERRITORY OF THE GDR IN 1962. H. Reissig (Technische Universität, Dresden). Kernenergie, 7: 117-27(Feb. 1964). (In German)

Studies of the ^{90}Sr content of soils and plants begun in 1960 and 1961 were continued. Pasture land showed a marked increase of ^{90}Sr content in 1962. Crop soils showed also an increase of average levels, but no significance could be established. The contamination of plant life increased as a result of the resumption of nuclear weapon tests in the fall of 1961. Plants with large specific surface area, such as grass or other fodder, were especially affected. In plants with smaller area or growing above ground the level remained about the same. The relationship between soil and plant contamination observed in previous years was less apparent in 1962. This can be attributed to the strong effect of surface contamination with ^{90}Sr that occurred during 1962. (OTS)

15910 MAXIMUM PERMISSIBLE LEVELS FOR INTERNAL CONTAMINATION. George V. LeRoy. 12p. (CONF-277-4)

From Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963.

The maximum permissible dose (MPD) concept is discussed both in terms of average annual occupational and accidental exposure. Evaluation procedures for determining the nature and amount of internally deposited radioactive materials are examined. (H.M.G.)

15911 FEDERAL RADIATION COUNCIL PROTECTION GUIDES. [C. G. Palmiter]. 12p. (CONF-277-5)

From Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963. 12p. (CONF-277-5)

The origin and purpose of the Federal Radiation Council (FRC) are summarized, and FRC actions are reviewed in historic perspective. Acceptance by the FRC of a commitment to develop definite proposals on guides applicable to the initiation of public health control actions related to fallout and environmental radioactivity generated a number of considerations that are briefly identified. (H.M.G.)

Radiotherapy and Radiodiagnosis

15912 (ACRH-20(p.25-36)) A NUCLEAR NEEDLE FOR USE IN NEUROSURGERY. A. Mullan, P. V. Harper, E. Tani, G. Vailati, and K. A. Lathrop (Chicago. Univ.).

This is taken from paper appearing in J. Neurosurg., Jan. 1964.

Construction of a $^{90}Sr-^{90}Y$ hermetically sealed applicator was undertaken at the Argonne Cancer Research Hospital. The resulting needle contained at the tip 54 mC of ^{90}Sr. Physical assay was made in a Lucite phantom against a U_3O_8 standard. For biological assay 100 lesions were made in 25 anesthesized animals. Periods of irradiation were 10, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, and 120 minutes. Animals were sacrificed daily for the first eight days postirradiation and on the 10th, 12th, 20th, 30th, 60th, 90th, and 240th days thereafter. Brains were removed and prepared for histologic examination. Photomicrographs indicate necrosis. Using the physical and biological measurements the needle was used clinically to produce high cervical cordotomy, mesencephalic tractotomy, thalamotomy, pallidotomy, cingulotomy, trigeminal ganglionotomy, and pituitary ablation. (H.M.G.)

15913 (TID-7689(p.1-11)) DIAGNOSTIC USES FOR TECHNETIUM-99m. Katherine A. Lathrop and Paul V. Harper (Argonne Cancer Research Hospital, Chicago and Chicago. Univ.).

Radioactive characteristics of ^{99m}Tc that make it useful in medical diagnostic applications are discussed. It was found that by using various chemical modifications of the isotope, localization within the body can be controlled, making it possible to obtain scans of the thyroid, liver, spleen, or brain in less than one hour after administration of the radioisotope. (M.C.G.)

15914 (TID-7689(p.11-14)) A RAPID SCREENING METHOD FOR DETECTING ABNORMAL PLASMA VITAMIN B_{12} BINDING SITES IN CHRONIC MYELOGENOUS LEUKEMIA USING ARM COUNTING. C. C. Lushbaugh and William Gibbs (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.).

It was previously established by others that plasma binding sites for vitamin B_{12} are abnormally abundant in persons with active chronic myelogenous leukemia (CML). The methods used in these studies, however, required either large doses of radioactivity or large samples of blood. In an attempt to overcome these problems, the changes in the radioactivity of a large volume of circulating blood were measured by continuous external counting of the forearm of persons with a large liquid scintillation well counter. Counts were made during and immediately after the intravenous injection of 0.5 μC of ^{60}Co cyanobalamin into the antecubital vein of the other arm. Two persons with CML and another patient with agnogenic myeloid metaplasia did not clear the vitamin from the arm as did the other 6 persons. Instead, the radioactivity of their arms rose progressively or did not change after an initial increase above the one minute value. (M.C.G.)

15915 (TID-7689(p.15-16)) EVALUATION OF I^{125} MEASUREMENT TECHNIQUES FOR CLINICAL APPLICATIONS OF RADIOIODINE. James S. Eldridge and Peter Crowther (Oak Ridge National Lab., Tenn.).

Several NaI(Tl) detectors in current use for ^{125}I detection were studied to determine possible effects of physical characteristics on the absolute disintegration-rate determination of ^{125}I. The invariance of results to crystal size and shapes is illustrated as an example. The method was found to be independent of sample volume up to 4 ml. (M.C.G.)

15916 (TID-7689(p.17-20)) THE USE OF I^{125} AS A LABEL IN IMMUNOLOGIC STUDIES. Frank W. Fitch, Katti Dzoga, Howard Benensohn, and Paul V. Harper (Chicago. Univ. and Argonne Cancer Research Hospital, Chicago).

The properties of ^{125}I for use in immunological tracer studies are discussed. Examples of its use are described. (M.C.G.)

15917 (TID-7689(p.25-8)) COMPARISON OF DIGITAL AND ANALOG METHODS FOR RADIOISOTOPE MEASUREMENT. Bergene Kawin and Frank V. Huston (Veterans Administration Hospital, Fort Howard, Md.).

Analog and digital methods of recording radioisotope concentrations measured during scanning of internal organs are compared. The advantages of the digital method were that measurements were found to be independent of any time collection period, and, using this method, all pulses were measured. (M.C.G.)

15918 (TID-7689(p.29-30)) POTENTIALS OF ISOTOPIC RADIOGRAPHY. M. L. Pool and Harry D. Spangenberg, Jr. (Ohio State Univ., Columbus and Ohio State Univ., Columbus. Coll. of Dentistry).

A method of reducing to a practical minimum the intensity of those radiations from radioisotopes that are suitable for the visualization of soft and hard tissues is discussed. Criteria were established for evaluation of radioisotopes for their usefulness in isotopic radiography or radiovisualization. Performance of image converter tubes in the visualization system is discussed. (M.C.G.)

15919 IMPROVED EQUIPMENT DESIGN FOR STUDIES ON THYROID UPTAKE. E. H. Cranswick and P. L. McFadden (Rockland State Hospital, Orangeburg, N. Y.). Am. J. Med. Electron., 1: 108-11(Apr.-June 1962).

A new patient support and modified arrangement of counting equipment for evaluation of thyroid radioiodine uptake are described. The counters are arranged in an array of three, supported in a common transverse vertical plane at right angles to the long axis of the bed. The advantages of the setup are listed. With the equipment employed, the correction factor required was large (up to 35%) and repeated estimations variable. Thus an additional feature was introduced by the interposition directly ahead of the crystals of $\frac{1}{32}$-in. Pb plates to block all the secondary radiation and some primary radiation of lower energy bands. This leads to a loss of about 35% of the sensitivity, but reduces the correction for scatter-absorption to ±2% of the raw neck counts (after subtraction of background). (BBB)

15920 ANALYSIS OF A SERIES OF CASES OF CARCINOMA OF THE ENDOMETRIUM TREATED BY RADIUM AND OPERATION: A 40-YEAR EXPERIENCE AT WOMAN'S HOSPITAL. Elise L. Renning and Carl T. Javert (Woman's Hospital, New York). Am. J. Obstet. Gynecol., 88: 171-7(Jan. 15, 1964).

A survey of 610 cases of endometrial cancer treated since 1919 when the first Ra was obtained, is presented. There were 50 cases of the 610 which received Ra treatment for benign disease from 1 to 20 yr prior to the development of cancer, an incidence of 8.2%. The indications for Ra treatment were menorrhagia, metrorrhagia, hyperplasia, fibromyomas, and polyps. The dosage varied from 1200 mg-hr to 3600 mg-hr. Two patients with carcinoma of the cervix who received 4200 mg-hr of Ra subsequently developed carcinoma of the endometrium (1200 cases of cervical cancer were treated with Ra since 1919). Thus 0.01% developed cancer of the endometrium after large doses of radium, whereas 2.3% of the total number that received small doses of Ra for benign disease developed cancer of the endometrium. This indicates that large doses of Ra do not necessarily produce endometrial cancer but

that small doses may do so. The majority of the 413 endometrial cancer cases receiving Ra were treated with 1600 to 2400 mg-hr doses; the most common dosage was 2400 mg-hr, which is very low according to present-day standards. The survival of the patients was more clearly related to the histological type and stage of cancer than the treatment per se. The 5-hr survival rate according to treatment showed a 31.9% survival in those treated with Ra and/or x rays. Vaginal hysterectomies gave only a 25% 5-yr survival, but subtotal hysterectomies showed a 53.6% survival rate. The primary hysterectomy overall survival rate was 65.3% and cases treated by preoperative Ra followed by hysterectomy, 68.3%. The difference in these last 2 groups is not statistically significant. (BBB)

15921 OSTEORADIONECROSIS OF THE MANDIBLE AND ITS TREATMENT. J. A. MacDougall, A. M. Evans, and R. K. Lindsay (British Columbia Cancer Inst., Vancouver, Can.). Am. J. Surg., 106: 816-18(Nov. 1963).

Various courses of management of patients whose teeth are present and who undergo radiotherapy are discussed. Results are described for the period 1940 to 1949, when radiation for mouth cancer was given by medium voltage x rays and by Ra implants and molds; no preradiation extractions were performed and no radical surgical operations were performed. In a total of 180 patients so treated, in nine osteoradionecrosis developed; and in five cases in edentulous mouths. A comparison is made with results over the following 10 yr. Since 1952 all patients with oral cancer were treated by an external Co^{60} source by single or multiple fields or by Ra implants and molds. During the period 1950 to 1959, 184 patients were treated by radiation; 31 of whom received preradiation dental extractions. Osteoradionecrosis occurred in nine instances, three of which were in edentulous patients. The decreased incidence in this group is attributed to the decreased differential absorption in bone from Co^{60} γ radiation. It is concluded that treatment of established osteoradionecrosis should be radical, and that pain, trismus, and deformity, progressing to fracture and fistula formation, should not be tolerated in the absence of cancer. The use of antibiotics and other methods to influence infection and pain serve only to prolong the disease. The surgical techniques of hemimandibulectomy, to remove devitalized irradiated areas, are described in detail. (BBB)

15922 PHYSICAL ASPECTS OF ELECTRON THERAPY USING THE 15 Mev LINEAR ACCELERATOR. A. L. Bradshaw and A. M. Maysent (St. Bartholomew's Hospital, London). Brit. J. Radiol., 37: 219-24(Mar. 1964).

Experiments leading to the design of applicators of various sizes giving a uniform field for the clinical use of the electron beam from the 15-Mev linear accelerator are described. Distributions measured using red Perspex show that the dose is uniform to within 10% for a depth of 3.5 cm from the skin surface for fields with a diameter greater than about 8 cm. The method of beam monitoring and the safety precautions adopted when using the electron beam clinically are also described. (auth)

15923 ELECTRON THERAPY AT 15 Mev. H. W. C. Ward (St. Bartholomew's Hospital, London). Brit. J. Radiol., 37: 225-30(Mar. 1964).

Experience in 15-Mev electron therapy is described, and details are given of three cases in which high-energy electrons were particularly suitable for radical treatment. The reactions to electron therapy are analyzed. A technique for changing the penetration of electrons over part of the treatment area is described, and the indications for high-energy electron therapy are discussed. (auth)

15924 A VACUUM OPERATED INSTRUMENT FOR HANDLING RADIUM TUBES. O. Englander (Royal Infirmary, Leicester, Eng.). Brit. J. Radiol., 37: 236-7 (Mar. 1964).

Application of known principles resulted in the design of an apparatus for reducing exposure of x-ray technicians during the loading and unloading of radium tubes. The device offers the advantage of an increased distance between radium and fingers as compared with the conventionally used 25 mm forceps. A diagram of the instrument is included. (H.M.G.)

15925 GAMMACARDIOGRAPHY: THEORY AND DETERMINATION OF OUTPUT, COLLIMATION AND CORRECTION FACTOR. G. Joyet, E. H. Brunner, A. Uehlinger, and A. Hauptmann (Hopital Cantonal, Zurich). Cardiologia, 43: 259-97(1963). (In French)

A method using precordial activity measurements after intravenous injection of a radioisotope was evaluated. On the basis of blood volumes through which the radioactive indicator flows in the field of the measuring collimator, it is shown that the formula of Stewart-Hamilton for calculating cardiac output requires a correction factor of 0.90 ± 0.05 with the apparatus used. The collimator has a large rectangular field of 10.5×12 cm in the median plane of the heart. A lead grid provides an almost constant sensitivity curve with a negligible penumbra on the borders of the field. After the measuring collimator was placed on the precordial region under radiological control, I^{131}- or I^{132}-albumin was rapidly injected intravenously; the time interval for its arrival in the heart was shortened to 1 to 4 seconds by an immediate injection of isotonic saline under pressure. Recording was made by a precision rate meter with a time constant of 0.1 sec connected to a fast recorder. Good separation of the curves of the right and the left heart was obtained. The average error between duplicate determinations of cardiac output was 6%. On a glass model with one chamber, the exponential character of the dilution curve was demonstrated. However, on the right side of the diphasic curve of the left heart this type of curve was not obtained and exponential extrapolation is justifiable only as a first approximation. For pathological cases where the dip in the left curve is very indistinct, a formula is given which makes it possible to calculate the output from the area of the curve of the right heart only. (BBB)

15926 PHOSPHATE EXCRETION AND PARATHYROID FUNCTION AFTER RADIOIODINE THERAPY AND THYROIDECTOMY. R. McG. Harden, M. T. Harrison, and W. D. Alexander (Western Infirmary, Glasgow). Clin. Sci., 25: 27-36(Aug. 1963).

It has been previously suggested that therapeutic doses of radioiodine may damage the parathyroid glands, but the association of hypoparathyroidism with radioiodine therapy in man has only rarely been reported. Moreover, in these patients it was not clear whether radioiodine was responsible for the hypoparathyroidism, and animal experiments have yielded conflicting results. In attempts to resolve this problem, measurements were made of the response of the parathyroid glands to a high-phosphate diet in four groups of patients: a control group without evidence of parathyroid or thyroid disease; patients with clinical features of hypoparathyroidism; a group after surgical thyroidectomy; and a group treated with radioiodine (6 to 300 mC I^{131}). In the second group no response by the parathyroids to a phosphate load was found and in the third and fourth groups a subnormal response was noted. As a measure of the response of the parathyroid glands to high-phosphate feeding, the phosphate excretion index (PEI) was used. The serum

Ca level was significantly lower in the post-thyroidectomy group when compared with the control group, but in the group treated with I^{131}, it was not significantly different from the control group. A review of reports of earlier cases shows that although hypoparathyroidism following thyroidectomy is well recognized it has rarely been described following therapy with radioiodine. In man, the parathyroid glands are generally situated on the surface of the thyroid, sometimes lying within its capsule. On occasion, they may lie partially within the thyroid gland, and, rarely, may be completely surrounded by it. In the latter circumstance a parathyroid gland would receive a greater radiation dose than parathyroids in the more usual sites. It is calculated that a completely embedded parathyroid gland receives about twice as much radiation as one situated on the surface of the thyroid. Other factors may be the size and the radioiodine uptake of the thyroid gland and variations in radiosensitivity of the parathyroid glands. In the present group of I^{131}-treated patients the response of the parathyroids to phosphate feeding was subnormal, although the serum Ca and control PEI did not differ significantly from those of the control group. It is concluded that diminished parathyroid reserve may result from radioiodine therapy and thyroidectomy. The possibility that damage to one parathyroid gland by radiation, by trauma during surgery, or by pressure from a large goiter, may result in the formation of antibodies which lead to the destruction of the remaining parathyroid glands is discussed. (BBB)

15927 HEAVY PARTICLES, THE BRAGG CURVE AND SUPPRESSION OF PITUITARY FUNCTION IN DIABETIC RETINOPATHY. John H. Lawrence, Cornelius A. Tobias, John A. Linfoot, James L. Born, Alexander Gottschalk, and Robert P. Kling (Univ. of California, Berkeley). Diabetes, 12: 490-501(Nov.-Dec. 1963). (UCRL-10906)

During the past six years heavy particles such as protons and alpha particles were used to achieve partial or complete hypophysectomy in an attempt to slow down the progressive, severe diabetic retinopathy in 71 patients. Pituitary suppression was indicated by fall in the insulin requirements and target-organ outputs of these patients. Sixty-one patients were followed long enough for reevaluation; the retinopathy had stabilized in 38 of these, and it was further noted that 14 of these 38 patients also showed improvement in visual acuity. The objective improvements observed in the appearance of the eye grounds were decreases in frequency of hemorrhages and microaneurysms and a decrease in neovascularization and exudates. Eleven patients had died: six with uremia, three of acute myocardial infarction, one of auricular fibrillation, and one of cardiovascular collapse. The findings indicate that retinopathy can be favorably influenced by suppression or ablation of pituitary function, but it is felt that patients with advanced cardiovascular and renal complications are not desirable candidates. (auth)

15928 AMOUNT OF β SELF-ABSORPTION IN H^3 AUTORADIOGRAPHY. W. Maurer and E. Primbsch (Universität, Cologne). Exptl. Cell Res., 33: 8-18(Jan. 1964). (In German)

The autoradiographic research on cell metabolism using tritium-labeled compounds has gained increasing significance in the last year. Because of the extremely short range of tritium beta radiation, the resolving dissolvent power can be correct within a fraction of a micron. On the other hand the short range offers the disadvantage of considerable tritium beta absorption occurring in the tissue section. The quantity of self-absorption must be known for tritium activity to be calculated from the number of silver grains over the cell structure. The process of measuring tritium beta self absorption by autoradiographic examination is reported. Furthermore, the relation between the number of silver particles and the absolute tritium activity of the tissue is studied. (tr-auth)

15929 THE USE OF RADIOACTIVE PHOSPHORUS P^{32} AND A MINIATURE GEIGER TUBE TO DETECT MALIGNANT NEOPLASIA OF THE GASTROINTESTINAL TRACT. Robert S. Nelson, William C. Dewey, and Raymond G. Rose (M. D. Anderson Hospital and Tumor Inst., Houston, Tex.). Gastroenterology, 46: 8-15(Jan. 1964).

A method for detection of gastrointestinal tumors is described in which the neoplasm incorporating high concentrations of P^{32} is located by a miniature Geiger counter attached to a gastroscope probe. The Geiger tube (25 × 5 mm with a sensitive area of 5 × 10 mm), the largest that could be safely passed, had an intrinsic efficiency of about 50% for detecting P^{32} particles and gave a counting rate of about 5500 cpm when placed above a solution of P^{32} with a concentration of 1 μC/ml. This miniature Geiger counter was incorporated in the tip of a long and fairly rigid Teflon plastic tube for esophageal testing and in the end of a controllable-tip gastroscope for use in the stomach. The same type of probe may be used in the rectum as in the esophagus. The patient to be explored was given 500 μC P^{32} intravenously 18 to 20 hr before examination. Of 62 esophageal tests, 25 patients had cancer, 5 benign lesions, and 32 were normal control subjects. There was an accuracy of 92% in cancer, and an overall accuracy of 95%. In 46 gastric tests, 22 patients had cancer, 11 had benign ulcer, 2 had benign tumor, and 11 were normal control subjects. The accuracy in gastric cancer was only 73%, largely because of technical difficulties. Overall accuracy was 83%. Rectal testing was carried out in only 5 patients, 4 of whom were correctly evaluated. It is concluded that although the Geiger counter probe technique cannot be used as a general survey method in the diagnosis of gastrointestinal cancer, it is highly accurate in detecting cancer of the esophagus and rectum, is valuable in differentiating obscure and equivocal findings. The routine dose of 500 μC delivers a raditaion dose of about 15 r to the bone marrow; this amount, although at least 100 times higher than that delivered from routine chest x rays, is less than the 30 r/yr which has been established as the permissible limit for radiation workers. With improved equipment, this dose may be reduced by a factor of 2 to 4. (BBB)

15930 THE QUANTITATIVE RATIO OF REQUISITE RADIATION TO AVAILABLE INFORMATION IN DIFFERENT RADIODIAGNOSTIC TECHNIQUES. J. Feddema. J. Belge Radiol., 46: 587-98(1963).

Quantitative specifications were prepared for both the dose and the picture. Tube voltages used were 50, 75, 100, 125, and 150 kv. Half-value layers of 2.0, 2.8, 3.8, 4.8, and 5.7 mm Al were measured with a total filtration equivalent to 2 mm Al. Focus/object distance was 80 cm and focus/film distance 100 cm. Measurements were performed using a thorax-equivalent and an abdomen-equivalent phantom. The values for bone and air were then determined, taking into account that the soft-tissue luminant state was put at 100. This method of representation thus corresponds exactly to the luminant state differences that are perceived by the human eye. Conventional fluoroscopy, at 100 kv and tube currents of 1 mA and 2 mA is compared with fluoroscopy aided by image intensification. It was found that image-intensified fluoroscopy at 0.5 mA is still superior

to conventional fluoroscopy at 2 mA. Conventional radiography with universal intensifying serums is compared with fluorography using a 16-mm and a 35-mm camera having the same lens apertures and mounted on the 9-in. image intensifier. It was concluded that fluorographic picture quality, a factor which is related to film grain coarseness, was inferior. Comparison is also made between the picture quality of a full-size radiograph and of a 70-mm single shot. It was decided that the best method of improving the picture quality of image-intensified pictures is provided by macroradiograpy or x-ray magnification. (H.M,G.)

15931 GALLIUM-68 AS A SCANNING AGENT FOR INTRACRANIAL LESIONS. C. Norman Shealy, Saul Aronow, and Gordon L. Brownell (Massachusetts General Hospital, Boston). J. Nucl. Med., 5: 161-7(Mar. 1964).

Gallium-68 was investigated as a possible agent for brain scanning for tumor localization. A number of compounds were tested, and several offer potential usefulness with positron cameras. The relative ease of obtaining Ga makes further work with it worthwhile. (auth)

15932 EARLY DIAGNOSIS OF METASTATIC BONE CANCER BY PHOTOSCANNING WITH STRONTIUM-85. N. David Charkes and David M. Sklaroff (Albert Einstein Medical Center, Philadelphia). J. Nucl. Med., 5: 168-79 (Mar. 1964).

Photoscans of bone utilizing 50 μC of Sr^{85} were made in 90 cancer patients with proven or suspected metastases to bone. In 11 patients the scan was positive and the x ray negative, and in 75 patients there was good agreement between the scan and the roentgenogram. The scan, however, frequently showed greater involvement than was apparent on x rays. These results were confirmed by bone biopsy in 14 patients. Phantom studies were carried out which indicated that there is good correlation between the scan and known isotopic volumes within bone. Bone tissue counts of radiostrontium content were also correlated with biopsy findings and lend further support to the validity of the method. It is concluded that the Sr^{85} photoscan can detect early metastatic cancer to bone prior to observable roentgenographic changes. Not only have these scans been of value in diagnosis, but they have allowed the radiation therapist to plan treatment portals more effectively. (auth)

15933 LABELING OF HUMAN GLOBULIN WITH I^{124} FOR POSITRON SCANNING OF NEOPLASMS. Stuart W. Lippincott, Cornelia Corcoran, Cornelius R. Jansen, John E. Jesseph, Kanti Rai, Saul Aronow, Margaret W. Greene, and William H. Sweet (Bowman Gray School of Medicine, Winston-Salem, N. C.; Brookhaven National Lab., Upton, N. Y.; and Massachusetts General Hospital, Boston). J. Nucl. Med., 5: 193-9(Mar. 1964).

Normal and aberrant gamma globulins were labeled by I^{124} produced by alpha particle bombardment of Sb in a 60-in. cyclotron. Localization of the labeled globulin in primary brain neoplasms was demonstrated by positron scanning. It appears possible by this procedure to investigate in various tissues and organs in man sites of catabolism of similarly labeled proteins. (auth)

15934 LANTHANUM-140 AS A MEASURE OF THE COMPLETENESS OF STOOL COLLECTIONS DEMONSTRATION OF DELAYED EXCRETION OF IRON-59. R. L. Hayes, J. E. Carlton, and Bill Nelson (Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Nucl. Med., 5: 200-8(Mar. 1964).

Lanthanum-140, as an unabsorbable tracer given with an oral dose of other substances, can be used to verify the completeness of stool collections for gastrointestinal absorption tests. However, when collections are incomplete, the proportion of La^{140} lost cannot be used to calculate the loss of unabsorbed Fe^{59} because the rates of passage through the intestinal tract are different. A distinct retardation of Fe^{59} excretion was observed. Lanthanum-140 is of use in studying this phenomenon, which probably can be attributed to exfoliation of epithelial cells containing Fe taken up from the intestinal tract. (auth)

15935 INTRALUMINAL BETA IRRADIATION IN LEUKOPLAKIA CONSTRICTING THE MALE URETHRA. John I. Perl (Augustana Hospital, Chicago). J. Urol., 91: 76-8 (Jan. 1964).

A new method of intraluminal implantation of a radioisotope is described and applied to the male urethra affected by leukoplakia. To inhibit stricture formation the involved 4-cm segment of the terminal urethra was irradiated intraurethrally with radioactive chromic phosphate. The device containing the isotope consisted of a length of No. 205 polyethylene tubing with an 8-cm-long radioactive chromic phosphate-impregnated silk pulled into its lumen. The isotope-containing segment (3 μC/cm) was bent to form parallel limbs and this portion was inserted into the distal 4 cm of the urethra, and the free ends of the extraurethral portions of the empty tubing were molded over the glands and secured with adhesive tape. The patient had no difficulty urinating while the device was in the urethra for 44 hr (1056 μC-hr). Follow-up examination showed that the leukokeratotic lesions had significantly decreased in size and thickness, but further intraurethral treatments were given until a total of ~7676 μC/hr irradiation was delivered to the distal 4 cm of the urethra. No induration developed along the urethra, the meatus remained wide, and there was no visible evidence of leukoplakia at later urethrocystoscopy. Since the introduction of the isotope-containing sealed tubular device into the affected part of the urethra was painless and simple, it is suggested that such locally applied irradiation is suitable for the treatment of leukoplakia of the urethra. Since the α particles, after traversing the polyethylene tubing, hardly penetrate beyond another 1 to 1½ mm into the mucosa, the radiotherapy does not affect the deeper periurethral structures. Furthermore, since β irradiation inhibits fibroblastic proliferation, its use in tubular structures like the urethra, where even a slightly contracting scar may readily produce stenosis, is particularly indicated, if for nothing else than as a prophylactic step against stricture formation. (BBB)

15936 LOW-DOSE FLUORORADIOGRAPHY. Norman Simon and Elliot I. Greenberg. N. Y. State J. Med., 63: 1388-91(May 1, 1963).

The technique described employs a 9-in. image-intensification tube, with a brightness gain of 3000 times, and still cameras mounted on an image intensifier and synchronized to make spot films of the output phosphor at doses $\frac{1}{10}$ to $\frac{1}{50}$ of the amount of radiation required in conventional spot filming. This method could be, it is suggested, a highly significant factor in the reduction of population radiation dose from medical diagnostic x rays, since fluoroscopy represents one of the greatest contributions to medical x-ray exposure. The device is constructed by mounting, directly above the aperture of the image-intensification tube housing, a freely moving slide with two Hasselblad superwide cameras aimed at the output phosphor. The film size, $2\frac{1}{4}$-in.^{2} is large enough to view without magnifying lens. The cameras have external motors and electric circuitry attached to their mounts to provide automatic film advance immediately after an exposure has been made. Two cameras were mounted to permit the use of two dif-

ferent focal-length lenses. The reduction of the dose of radiation from 1/10 to 1/50 of the required intensity with conventional methods means that less exposure is used in making a full set of spot films with still photography of the image-intensification output phosphor than in making a single spot film exposure with conventional methods. Measurements were made of entrance and exit doses in patients and phantoms during the course of spot filming. With a 20-cm phantom the entrance and exit doses during conventional spot filming were 265 and 7 mr, respectively. With the image-intensification tube, the entrance dose was 8 mr and the exit dose 0.6 mr. During fluoroscopy with conventional equipment and conventional factors the usual entrance dose rate at the table top between the patient and the tube was 6 r/min. The usual dose rate with the image intensifier was 0.3 r/min, representing a diminution of radiation of 20 times. The Sanitary Code of the State of New York advises a dose rate at the table top of 10 r/min or less. Advantages of some of the practical aspects of this type of fluoroscopy and spot filming are discussed. The long time required for dark adaptation for efficiency in fluoroscopy is practically eliminated, and a light fluoroscopy room reduces patient anxiety. Resolution and contrast of the image were measured with a test pattern. The resolution and contrast, as seen in the mirror-viewing system during image intensity fluoroscopy of the test pattern, were equaled or bettered on the still photograph of the same image. The system resolved 35 to 40 line pairs/in. and registered contrast at a 5% level. The limitation in resolution appears to be in the image on the output phosphor rather than in the still photography unit. In considering the hazards of radiation in general, it is concluded that the somatic effect of radiation at diagnostic dose levels is not of significance, but low levels of dose used in diagnostic x-ray examinations may represent a genetic hazard. If the use of image intensification could decrease the fluoroscopic dose and spot filming dose to gonads by a factor of 1/10 to 1/50 as with the described device, this could represent an appreciable lowering of gonadal dose. (BBB)

15937 THE RELIABILITY OF RADIOISOTOPIC ENCEPHALOGRAPHY: A CORRELATION WITH OTHER NEURORADIOLOGICAL AND ANATOMICAL STUDIES. Gordon S. Dugger and Francis D. Pepper (Univ. of North Carolina, Chapel Hill). Neurology, 13: 1042-53(Dec. 1963).

Brain scans with this diagnostic procedure were used for evaluation of patients suspected of having intracranial neoplasms. The results showed a high degree of accuracy and it is proposed that isotopic encephalography is of equal value as pneumography and angiography in diagnosis and localization of intracranial lesions. The preparation used in brain scintiscanning was Hg^{203}-labeled chlormerodrin (Neohydrin); Hg^{203} has physical properties that make it useful in brain scanning. The single line emission of Hg^{203} at 0.28 Mev minimizes scattering. Although Hg^{203} has a longer physical half life than I^{131}-labeled human serum albumin, which has been widely used in brain scanning, this objection can be largely overcome by putting the Hg^{203} in the compound chlormerodrin which has a short biological half life. Chlormerodrin is rapidly cleared from the blood, and produces a favorable target-nontarget ratio of activity between the tumor and the brain, which permits earlier scanning than with I^{131}-albumin. The kidneys retain about 10% of the chlormerodrin-Hg^{203} with a half life of 28 days, producing a radiation dose of 34 to 40 rad from the usual dose used in brain scanning. To reduce this renal uptake of the radioactive material, 1 to 1.5 ml of meralluride (Mercuhydrin) is given intramuscularly as a blocking dose the day before administration of chlormerodrin-Hg^{203}. The patients were given 600 μC chloromerodrin-Hg^{203} intravenously approximately 4 hr before scanning. The use of isotopic encephalography for evaluating the results of surgical and radiation therapy in brain tumors was also studied. Several patients showed decreases in the areas of uptake, and others an increased uptake at a time which corresponded with clinical progression of their disease. Small children should not be submitted to this technique because of the radiation the kidneys receive. (BBB)

15938 A STUDY OF SOME PROPERTIES OF TWENTY-THREE DIFFERENT DENTAL X-RAY FILMS. J. van Aken (Tandarts, Utrecht). Oral Surg., Oral Med., Oral Pathol., 15: 1330-48(Nov. 1962).

Because of the importance of reducing exposure of patients to lowest possible levels in radiographic techniques, sensitivity of various commercially available films was evaluated. On a subjective basis, the speed of 23 different types of film was estimated by 130 observers. The fastest film available is three times as fast as the slowest film. The fog and base density, the contrast, and the graininess of the films were also estimated. These factors are independent of each other. Only the sensitivity and graininess show a correlation. Information was also collected with respect to the color of the film, the protection against moisture by packaging, the identification mark, the thickness of the film, the number of emulsion surfaces, the expiration date, and the exposure time according to the manufacturer's directions for use. Differences in protection against moisture through packaging, lack of information regarding expiration dates, and unsatisfactory information on technical data in connection with the exposure time were found. (BBB)

15939 RADIATION EXPOSURE FROM RADIOIODINE COMPOUNDS IN PEDIATRICS. Ronald A. Seltzer, James G. Kereiakes, Eugene L. Saenger, and Dale H. Myers (Univ. of Cincinnati and U. S. Public Health Service, Washington, D. C.). Radiology, 82: 486-94(Mar. 1964).

The average radiation doses received by the whole body of normal infants and children of varying ages during diagnostic tests with various compounds containing radioiodine were calculated. From a given quantity of I^{131} the average dose was found to be up to 20 times that received by standard man. This striking difference stresses the need for establishing a standard child for each of several age groups to estimate the risks sustained from various internally deposited radionuclides. The average doses from radioiodine may vary by a factor of 50 to 80, depending on the chemical form in which the isotope is administered. Knowledge of the metabolism of the chemical form is essential to the estimation of the radiation dose delivered. The average whole-body radiation doses sustained during diagnostic tests in which radioiodine is used are often smaller than those sustained during various fluoroscopic and radiographic procedures. Selected tissues may receive larger doses. A comparison of doses delivered by three radioactive isotopes of iodine demonstrates the reduction in radiation dose possible by the use of I^{125} and I^{132} in lieu of I^{131}. (auth)

15940 PAEDIATRIC RADIOLOGY USING SHORT EXPOSURE TIMES. P. Grattan-Smith (Royal Alexandra Hospital for Children, Sydney). J. Coll. Radiologists Australasia, 6: 155-6(Dec. 1962).

Steps were taken to reduce radiation dosage to patients and staff, by use of only high-speed screens and film, and reduction of the area of patient irradiated. One important

source of unnecessary radiation is the repeat radiograph, owing to the previous attempts being spoiled by movement blur, and attempts to solve this problem are described. A child is naturally apprehensive in the strange surroundings of a radiographic room, and forceful immobilization of the child can only result in refusal to co-operate, causing unnecessary radiation to the patient and attendant staff. A survey of film wastage shows a considerable reduction in the number of unsatisfactory films since the adoption of short-exposure techniques. (BBB)

15941 DOSIMETRY OF THE ISOTOPE I^{131} ADMINISTERED FOR DIAGNOSTIC AND THERAPEUTIC PURPOSES. Istvan Krasznai and Janos Foeldes ([Municipal Public Health and Communicable Diseases Station,] Budapest). Magy. Radiol., 14: 232-40(July 1962). (In Hungarian)

Questions are raised as to the maximum permissible isotope dosage for diagnostic purposes, calculation of effective dosage and adequate shielding for therapeutic purposes, and criteria for use of isotopes for diagnostic and therapeutic purposes. Studies are provided mainly for I^{131}, and equations are given for calculation of the appropriate doses for thyroid diagnosis and for estimation of the dose reaching the gonads. For practical applications, attention is called to the fact that the calculation of duration of I^{131} exposure must take into account both the half life of the isotope as well as the speed of its absorption by and excretion from the body. A discussion is provided of the techniques for I^{131} use for therapeutic purposes, mostly in case of thyrotoxicosis in patients 45 yr and older. The dangers of radioisotope-induced cancer is discussed, but no conclusions are made at this time. (BBB)

15942 THE HEALING OF WOUNDS WITHIN IRRADIATED TISSUE. John S. Spratt, Jr., and Jose M. Sala (Ellis Fischel State Cancer Hospital, Columbia, Mo.). Missouri Med., 59: 409-11(May 1962).

The effect of ionizing irradiation, at doses used in radiotherapy of cancer, on tissues adjacent to the tumor is discussed, particularly with respect to healing and later surgical intervention. A survey of available data shows that as little as 500 r, single dose given preoperatively, reduces the rate of wound contraction and that any tissue receiving in excess of 1300 r from a single dose is subject to spontaneous necrosis. No proliferation of either lymph or blood capillaries occurs after wounding in mammalian tissue that has received previously more than 2000 r in a single dose. However, capillary regeneration occurs normally in tissues irradiated with single doses of 1000 r or less. Following single doses of from 1000 to 2000 r, capillary regeneration occurs irregularly and the flow of red blood cells through these capillaries is slow. In addition, the capillaries in tissue receiving over 1000 r tend to rupture. Extensive lymph and blood capillary budding normally follows injury and infection in nonirradiated tissue, and inhibition of capillary budding by irradiation may contribute to necrosis and nonhealing of wounds within irradiated tissues. Knowledge of correlation of time-dose factors of preoperative irradiation with the ability of wounds to heal is necessary if increased mortality and morbidity from surgical procedures are to be avoided. A mid-pelvic dose of 4000 rad given by protracted therapy (3 to 4 weeks) seems compatible with postirradiation hysterectomy and lymphadenectomy, but when surgery is performed in pelves that have received 6000 rad or more (5 to 6 weeks) the frequency of complications rises precipitously. Important considerations before undertaking surgery in irradiated tissue are included. Radiotherapeutic factors that govern specific surgical restrictions are enumerated. (BBB)

15943 DOSE DISTRIBUTION IN GRID THERAPY WITH 15-Mev ELECTRONS. C. Bompiani and A. V. Diel Vescovo (Università, Rome). Panminerva Med., 5: 313-18(Oct. 1963).

Results are reported on: the influence of beam sizes on depth dose distribution; surface dose increase at points corresponding to grid apertures in relation to the size of holes and type of beam collimation; and depth dose distribution in relation to the aperture ratio and size of holes. Dosimetry was carried out with the photographic method. Dose-depth curves were prepared by exposure of 12 films inserted, perpendicular to the beam axis, between layers of water-equivalent phantom material. Blackening was measured with a transmission photometer. The depth doses in the exposed and covered areas of the phantom were calculated by comparing the characteristic distribution curve with the areas of blackening in the film corresponding to the spaces and bars of the grid at the central rays of the beam. The first study used a lead grid 1-cm thick with round 8-mm holes and a 50% aperture ratio. The other two grids used had 10- and 12-mm holes with 35% and 50% aperture ratios, respectively. The results showed that beam size does not affect an appreciable extent the distribution of the dose beneath the grid with regard to the depth at which the dose becomes homogeneous. The percentage depth dose at the level of homogeneity is virtually independent of the beam size. Beyond the level of homogeneity the differences between the curves with respect to fields of different sizes are almost negligible. The surface dose at the points corresponding to the apertures of a grid is greater than the surface dose obtained from irradiation without a grid. This difference in surface dose depends not only on such factors as the type of material and thickness of grid but also on the size of holes in the grid. The relation of the surface dose to the size of grid hole varies according to the system of beam collimation used. The intensity of the homogeneous dose for a given grid aperture is not greatly affected by the size of grid hole (at least within the limits studied, 0.8- to 1.2-cm holes). The depth at which the dose becomes homogeneous is less for grids with smaller holes, aperture ratios being considered equal for purposes of comparison. The layer which can be considered homogeneous with regard to dose distribution—approximately the same thickness for the two types of grid examined—is at a higher level with the grid with smaller holes. At the points corresponding to the grid apertures, the absorbent medium between the surface and the level of homogeneity receives, a smaller percentage dose from radiations passing through the smaller grid holes. Conversely, the protected zones between the surface and the level of homogeneity receive a somewhat smaller dose of radiation passing through the larger grid holes. (BBB)

15944 EYE STRAIN AND EYE PROTECTION DURING IRRADIATION THERAPY AND DIAGNOSIS. E. Krokowski (Freie Universität, Berlin). Radiographica, No. 7, 152-60 (Oct. 1963).

Sensitivity of various components of the eye is surveyed and means for preventing injury to them discussed. Pertinent experiments by the author on rabbits are described. The lens is the most radiation-sensitive part of the eye; two dependent changes take place after irradiation: clouding, and weight alterations of the lens. Cataract starts as a clouding of the posterior commissure, extends into the capsule, and at high doses there may be clouding of the

entire lens. Once clouding of the lens has begun it does not disappear. The threshold dose producing cataracts in young animals is about 200 r. Weight alterations of the lens, due to changes in water content or possibly growth inhibition or destructive changes, appear at doses far below those needed to produce clouding. The threshold dose for clouding of the cornea is about 10 times that for the lens. Doses in excess of 2000 r result in corneal clouding in 70% of the cases, but are reversible. The conjunctiva is also relatively insensitive to irradiation. When the eyes of young animals are irradiated, development of the whole eye is retarded. A 12% reduction in the weight of the eye follows absorption of 1000 rad, and this rises to 40% at 2000 rad. The RBE of different forms of radiation on damage to the lens is tabulated. Effects of radiation on the eye vary directly with the dose absorbed, and inversely with the age of the animal at the time or irradiation, both of which reduce the time of onset and intensity of manifestations. Age determines both the latent period before onset of symptoms, and the time to develop full damage. Radiation injury occurs in four stages that are identified. Any necessary x-ray examinations of the eye may be undertaken and repeated when required, without fear of complications, as no methods of x-ray diagnosis give a surface dose approaching 200 r, but caution is required in therapeutic irradiation of the head region. The radiation dose at the lens during treatment of tumors of the antra, orbits, nasopharynx and palate, and of the brain show that the threshold dose for irradiation cataract is exceeded by some methods. Also discussed is the extent to which the eyes of a radiologist in a diagnostic department are endangered by radiation exposure. (BBB)

CHEMISTRY

General

15945 (LADC-6084) ELECTROLYSIS AND EXTRACTION OF SOME LANTHANONS FROM AQUEOUS ELECTROLYTES WITH LITHIUM AMALGAM. E. I. Onstott, W. H. Smyrl, and R. F. Macander (Los Alamos Scientific Lab., N. Mex.). [1963]. Contract [W-7405-eng-36]. 14p. (CONF-405-5)

From 4th Rare Earth Research Conference, Phoenix, Ariz.

Phase transfer of Pr by electrolysis at a lithium amalgam cathode was found to be linear with time for fixed electrolysis conditions. The rate of electrolysis of Pr decreased with increasing lithium citrate concentration. Extraction of Pm from Pm–Gd mixtures with saturated lithium amalgam was found to vary with virtually any change in electrolyte composition. The Pm extraction was first order with respect to Pm concentration, but the extraction rate decreased with increasing excess citrate concentration. The presence of Gd did not affect the extraction of Pm very much at Gd concentrations less than 0.1 M, but at higher concentrations of Gd the amount of Pm extracted was diminished. The results indicate that the exchange reactions are very fast and it may be possible to interpret rate data in terms of equilibria in the electrolyte phase. (auth)

15946 (MLM-1165(Tr)) POLONIUM. M. Haissinsky. Translated by Robert C. Lange (Mound Lab., Miamisburg, Ohio), from p.2041-2122 of "Nouveau Traite de Chimie Minerale, 13: Pt. 2," Published by Masson et C^ie, Editeurs, Paris, 1961. 65p.

A review is presented of all aspects of polonium. These aspects include isotopes and nuclear properties, separation and purification, physical and chemical properties, and inorganic and organic compounds. Bibliographies are included. (D.L.C.)

15947 ON THE CHEMISTRY OF TECHNETIUM. K. Schwochau (Universität, Cologne). Angew. Chem., 76: 9-19(Jan. 7, 1964). (In German)

A review is presented of several aspects of the chemistry of Tc. Nuclear chemical preparations of the element are indicated; the isotopes are tabulated with their half lives and decay modes. The preparation of Tc^{99} is outlined. Special emphasis is laid on the nuclear properties and handling of Tc^{99}. Under the general heading of chemistry of Tc are discussed oxidation states (table, comparison with Mn and Re) and redox potentials, preparation, and properties of Tc metal and intermetallic compounds (table of physical properties, comparison with Mn and Be) including reactions of the metal, oxygen compounds with emphasis on the pertechnetates (tables of properties of monovalent cation pertechnetates, ir and uv spectra of ammonium pertechnetate and perrhenate), thermodynamic data for O compounds, descriptive chemistry of S compounds and halogen compounds, including the properties of halogen-O-compounds, halogen complexes (absorption spectra of TcF_6^{-2}, $TcCl_6^{-2}$, $TcBr_6^{-2}$, and TcI_6^{-2}), cyano and thiocyanato complexes, complex hydrides, carbonyl compounds, and compounds with organic ligands (table of properties of o-phenylene-bis(dimethylarsine) complexes). The analytical chemistry discussion covers the topics of radiometry of Tc^{99}, spectroscopy and spectra photometry, polarography, precipitation reactions, extraction methods, and separation procedures. Uses of Tc are briefly mentioned. There are 157 references cited. (BBB)

Analytical Procedures

15948 (CEA-2391) ETUDE DU DOSAGE DE L'EAU OXYGENEE PAR SPECTROPHOTOMETRIE ULTRA-VIOLETTE. (Study of the Dosage of Hydrogen Peroxide Using Ultra-Violet Spectrophotometry). J. Besson and J. Spitz (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Grenoble). 1963. 11p.

A continuous determination of hydrogen peroxide by means of uv spectrophotometry at about 2000 A, gives very satisfactory results. This method seems to be well adapted to the special case of the cooling water of a nuclear reactor (10-20 mg/l H_2O_2) and could thus provide a new possibility of controlling this reactor. (auth)

15949 (EUR-585.i) DETERMINAZIONE DELL'ALLUMINIO NEL SAP. (Determination of Aluminum in SAP). W. Leyendecker and G. Serrini (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy). 1964. 15p.

A sufficiently rapid method for the quantitative determination of aluminum in SAP powders and sintered products is described. In both cases the standard deviation is ±0.25% for Aluminum contents between 82 and 94% and for a sample of about 0.350 g. Possible interferences were investigated. (auth)

15950 (EUR-587.e) THE CHROMATOGRAPHIC CONCENTRATION AND THE SPECTROGRAPHIC DETERMINATION OF TRACES OF CADMIUM, YTTRIUM, SCANDIUM AND LANTHANONS IN URANIUM METAL. Ch. A. Berthelot, S. Herrmann, K. F. Lauer, and R. A. A. Muzzarelli (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy and European Atomic Energy Community. Central Nuclear Measurements Bureau, Geel, Belgium). 1964. 27p.

The cadmium and rare earths from 30 g uranium metal are concentrated on a 20 g cellulose column, and the residual uranium is eluted using ethyl ether containing 5% of nitric acid. The activated cellulose is ignited at 500°C. One part of the ashes is mixed with zinc oxide for the spectrographic determination of cadmium. The other part is mixed with lithium carbonate for the spectrographic determination of scandium, yttrium, and lanthanons. The limits of detection are: 0.5 ppb for Yb and Sc; 2 ppb for Dy, Er, Eu, and Y; and 5 ppb for the other rare earth metals and Cd in uranium. The problem of lanthanum in uranium when used as internal standard is discussed. (auth)

15951 (GA-4855) DEVELOPMENT OF NEUTRON ACTIVATION ANALYSIS PROCEDURES FOR THE DETERMINATION OF OXYGEN IN POTASSIUM. First and Second Quarterly Report, Period Ending December 26, 1963. E. L. Steele and H. R. Lukens, Jr. (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Jan. 10, 1964. Contract NAS3-2537. 30p.

The principles and techniques of activation analysis are analyzed with respect to the determination of oxygen in metals, especially alkali metals. Emphasis is placed on fast and thermal neutron activation methods. The investi-

gations show that the neutron-proton reaction on oxygen-16 is best suited for determining oxygen content in metals from considerations of time required per analysis, equipment availability and cost, concentration sensitivity, and convenience. Experimental results obtained show that standard deviations in the 10 to 1000 mg oxygen range with current equipment are less than 2%. A sensitivity of 3.5×10^5 N^{16} photopeak counts per gram is achieved with a 500-μa beam current at a sample distance of 2 cm. Tests show that metal capsules are not suitable for reactor irradiations, but they are fine for accelerator irradiations. Aluminum is the best metal found thus far for capsules. A description is given of an automatic activation-analysis system. (N.W.R.)

15952 (IS-800) CHEMICAL ANALYSIS OF ALKALI METAL TUNGSTEN BRONZES. Bruce Alan Raby and Charles Banks (Ames Lab., Ames, Iowa). Nov. 1963. Contract W-7405-eng-82. 92p.

A method has been developed for the chemical analysis of the three major constituents in alkali metal tungsten bronzes: alkali metal, tungsten, and oxygen. The analyses are based on the reactions of bromine trifluoride and hydrogen with the bronzes. This analytical system has been successfully employed for alkali metal tungstates and tungsten oxides as well as for the bronzes. Bromine trifluoride reacts with tungsten bronzes to produce alkali metal tetrafluorobromate(III), tungsten hexafluoride, bromine, and oxygen. At the temperature of dry ice, oxygen is the only product which is not a solid; it is transferred into a constant volume manometer for measurement. Subsequently, the bromine, tungsten hexafluoride, and excess bromine trifluoride are distilled out of the reactor. This operation isolates the alkali metal tetrafluorobromate(III) which is easily rinsed out of the reactor with dilute sulfuric acid and converted to the alkali metal sulfate for gravimetric determination. Because the tungsten–fluorine system is quite complex, it is necessary to determine tungsten in quite a different manner. The bronzes react with hydrogen to produce alkali metal oxide, tungsten metal, and water. Tungsten is the only non-volatile product and remains in the reaction boat for direct weighing. Although hydrogen reduction is valid for the other alkali metal compounds, it cannot be used with the corresponding lithium compounds because of the low volatility of lithium oxide. Lithium bronzes are dissolved by a basic, oxidizing fusion which converts the bronze to water-soluble tungstate. Tungsten is determined in this case by precipitation with hydrogen peroxide and nitric acid; the precipitate is ignited to and weighed as tungsten trioxide. This analytical system is capable of determining all the constituents of alkali metal tungstates and bronzes and in tungsten oxides with an accuracy better than 0.5 to 0.7 per cent of the relative values. Two interesting items of information were produced by this research. One is that the oxygen-to-tungsten ratios of alkali metal orthotungstates and bronzes are really 4.000 and 3.000 respectively; the corresponding lithium compounds appear to be anomalously oxygen-rich. The other is a determination of the correct conditions for the preparation of tungsten trioxide so that there are no interferences by volatility and changes in stoichiometry. (auth)

15953 (LAMS-3034(p.201-4)) EFFECT OF ASHING TEMPERATURE ON CESIUM AND POTASSIUM CONTENT OF BONE. M. A. Van Dilla, M. W. Rowe, and M. J. Fulwyler (Los Alamos Scientific Lab., N. Mex.).

Ashing of bone samples at 600 to 900°C was found to reduce the natural ^{40}K content by about 30% and to drive off all the ^{137}Cs present in the bones. (C.H.)

15954 (LAMS-3034(p.313-18)) NUCLEIC ACIDS: A TECHNIQUE FOR AUTOMATED BASE ANALYSIS. G. R. Shepherd, D. G. Ott, and P. A. Hopkins (Los Alamos Scientific Lab., N. Mex.).

A chromatographic procedure is described for the automated flow analysis of hydrolyzed nucleic acids. (C.H.)

15955 (NP-13761) FAST ACTIVATION ANALYSIS WITH VAN DE GRAAFF NEUTRON SOURCES INCLUDING TABULATION OF FAST-NEUTRON ACTIVATION CHARACTERISTICS OF THE ISOTOPES. J. H. Cherubeni (High Voltage Engineering Corp., Burlington, Mass.). May 1962. 20p.

The use of thermal and fast neutrons in activation analysis is considered. Useful neutron-producing reactions are tabulated, and the Van de Graaff accelerator as a neutron source using the $^3H(d,n)$ reaction is discussed. A compilation of fast neutron reactions, nuclear parameters, and applicability for activation analysis is given for a large number of isotopes. The factors affecting the sensitivity are discussed. A table is given which compares the detectability of the elements using fast and thermal neutrons. (D.L.C.)

15956 (NP-13762) ACTIVATION ANALYSIS WITH VAN DE GRAAFF NEUTRON SOURCES INCLUDING TABULATION OF THERMAL-NEUTRON ACTIVATION CHARACTERISTICS OF THE ISOTOPES. E. A. Burrill and A. J. Gale (High Voltage Engineering Corp., Burlington, Mass.). May 1954. Revised Nov. 1961. 12p.

A discussion is presented of the basic principles of thermal neutron activation analysis and the neutron sources involved. The production of neutrons from a Van de Graaff accelerator using the $Be^9(d,n)$ reaction and a moderator is considered. Tables are presented which list pertinent nuclear data for each element, for use in activation analysis. A summary table is also presented which compares the order of magnitude of the detectability of all the elements by activation analysis. (D.L.C.)

15957 (RT/PROT(63)-13) DETERMINAZIONE DI ALCUNI METALLI ALCALINI E ALCALINO TERROSI MEDIANTE SPETTROFOTOMETRIA DI FIAMMA—APPLICAZIONI NELLE ANALISI DI TERRENI, ACQUE E CAMPIONI BIOLOGICI CON RIFERIMENTO A STUDI DI RADIOATTIVITA AMBIENTALE. (Determination of Alkali and Alkaline Earth Metals by Flame Spectrophotometry—Applications to the Analysis of Soils, Water and Biological Samples with Reference to the Study of Radioactive Environment). M. M. Ferraris (Italy. Comitato Nazionale per l'Energia Nucleare. Divisione di Biologia e di Protezione Sanitaria, Rome). Oct. 1963. 14p.

The difficulties in the determination of alkali and alkaline earth metals are outlined. Some experimental data both on potassium, cesium, calcium, and strontium determination, and on ionization and self-absorption effects are reported. A method which enables to eliminate the disadvantages caused by the above mentioned effects is also reported. Some methods for alkali and alkaline earth metals determination in soils, waters, and biological samples are described. (auth)

15958 (SCPRI(S)-81) METHODE DE DETERMINATION RADIOCHIMIQUE DU 90 STRONTIUM DANS LES EAUX DE PLUIE. (Method of Radiochemical Determination of Strontium-90 in Rain Water). B. Herszberg, M.-T. Dutailly, and C. Burg (France. Service Central de Protection contre les Rayonnements Ionisants, Paris). 1962. 26p.

A method for determining Sr^{90} in rainwater is described. The radioisotopes are captured in ion exchange resins, which are then burned in an electric oven. Strontium sul-

fate is separated from the other resulting sulfates by precipitation in sulfuric acid. The Sr^{90} is then determined from the Y^{90} activity. The results of an investigation of the technique are included. (D.C.W.)

15959 (SCPRI(S)-94) QUELQUES OBSERVATIONS SUR UNE METHODE DE DOSAGE IMMEDIAT DE L'IODE 131 DANS LE LAIT, SUR LA POSSIBILITE D'EN AUGMENTER LA SENSIBILITE, ET SUR SON EXPLOITATION EN SERIE EN CAS D'ACCIDENT NUCLEAIRE. (Some Observations on a Method for Rapid Determination of Iodine-131 in Milk, on the Possibility of Increasing its Sensitivity, and on its Use in Series in Case of a Nuclear Accident). P. Pellerin, M. L. Remy, and J. P. Moroni (France. Service Central de Protection contre les Rayonnements Ionisants, Paris). Oct. 1963. 3p.

The method set forth by Murthy (adsorption of iodine 131 in milk on anionic resin) is resumed with a view to applying it systematically in case of a nuclear accident. By utilizing two scintillation detectors set up in parallel and a 512 channels spectrometer, its sensitivity can be raised to 20 picocuries of iodine 131 per liter of milk for a total operating duration of two hours (and to 5 picocuries for an 11 hours total operating duration). (auth)

15960 (SGAE-PH/CH-1/1964) A COMPARATIVE STUDY OF PUBLISHED METHODS FOR QUALITATIVE AND QUANTITATIVE ANALYSIS OF IRRADIATED AND UNIRRADIATED FUEL SAMPLES. (Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Vienna). [1964]. 95p.

A literature review is presented on nondestructive and destructive methods for analyzing nuclear reactor fuels. The methods for unirradiated and irradiated fuels are treated separately, although the methods frequently are identical except for difficulties in handling irradiated fuels. Methods yielding the same quantities are compared in tables. Flow sheets are given for the chemical separation procedures. Determination of Pu, U, and fission products and isotopic analysis are covered. (D.L.C.)

15961 (TID-7688(p.20-1)) LIQUID SCINTILLATION COUNTING OF IODINE-129 AND IODINE-125. Rober E. Yerick (Lamar State Coll. of Tech., Beaumont, Tex.) and Harley H. Ross.

Separation of iodine was accomplished by oxidation to I_2 and solvent extraction into toluene. 2-Methyl-1-butene was added to the organic phase to eliminate quenching, and scintillation counting was carried out with a toluene solution of PPO and POPOP. The results are tabulated; efficiencies of 86 and 14% were obtained for I^{129} and I^{125}, respectively. The method is linear and reproducible. (D.L.C.)

15962 (TID-7689(p.81-5)) RADIOISOTOPES IN ALKALINE-EARTH ANALYSIS. S. A. Reynolds (Oak Ridge National Lab., Tenn.).

Studies were made of the use of radiotracers in determination of the alkaline earth elements, calcium, strontium, and barium. Methodology and advantages of the radiotracer approach are discussed, examples in procedure development are given, and typical analytical results are listed. (M.C.G.)

15963 (UCRL-7618) A MANOMETRIC METHOD FOR THE DETERMINATION OF OXYGEN IN ORGANIC COMPOUNDS. Jack W. Frazer (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 17, 1963. Contract W-7405-eng-48. 10p.

A vacuum analytical method for the determination of oxygen in organic compounds was developed. Several milligrams (usually 3 to 5 mg) of the organic to be analyzed are sealed in an evacuated quartz bomb along with 2.5 to 3.5 mg of an organic reducing agent. Next the bomb is fired at 1050–1055°C for 30 minutes or longer. At the end of the heating period the bomb temperature is rapidly lowered from 1055°C to <650°C. As a last step the gaseous products are removed from the bomb and the volumes of CO and H_2 are determined. From these values the percentage of oxygen can be calculated providing an appropriate blank is obtained. Compounds containing carbon, hydrogen, nitrogen, sulfur, iodine, and chlorine have been successfully analyzed for oxygen. Organic compounds containing fluorine cannot be analyzed for oxygen by this method, because fluorine reacts with quartz to form oxygen and silicon tetrafluoride. (auth)

15964 (WCAP-2540) AN ANNOTATED BIBLIOGRAPHY OF ANALYTICAL METHODS FOR ALKALI METALS. E. E. Garcia and B. D. LaMont (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). [Mar. 1964]. Contract AT(30-1)-3186. 40p.

A total of 107 abstracts is presented on analytical methods for alkali metals, as a part of a program for the evaluation of the performance of the primary cold trap from the Enrico Fermi Reactor. The abstracts are arranged into sections dealing with general aspects; sampling and dissolution techniques; and determination of uncombined alkali metal, oxygen, carbon, hydrogen, nitrogen, and other impurities. (D.L.C.)

15965 DETERMINATION OF SULFUR IN POLYSACCHARIDES BY NEUTRON ACTIVATION ANALYSIS. Esther L. McCandless (Univ. of New York, Buffalo and Public Health Research Inst. for Chronic Disease, Buffalo). Anal. Biochem., 7: 357-65(Mar. 1964).

The method of neutron activation analysis was described in application to S determination in algal polysaccharides. Bombardment of micrograms of S with fast neutrons in a nuclear reactor results in an (n,p) reaction with the production of sufficient radioactive phosphorus (^{32}P) for quantitative detection with an ordinary Geiger counter. A 10-day period after activation was found necessary to allow decay of short-lived radioisotopes produced by activation. Subsequent to this 10-day cooling off period, the materials activated decayed with a $t_{\frac{1}{2}}$ of 14.3 days, characteristic of ^{32}P. A device was fabricated to rotate samples in the reactor during activation, to assure a uniform neutron flux to each sample. The method is recommended for its precision, sensitivity, and simplicity. (auth)

15966 POTENTIOMETRIC TITRATION OF FREE ACID AND URANIUM IN URANIUM(VI) SOLUTIONS WITH ALKALI. Kenji Motojima and Kimie Izawa (Japan Atomic Energy Research Inst., Tokyo). Anal. Chem., 36: 733-5(Apr. 1964).

A simple method for the determination of free acid and uranium(VI) in uranium solutions by alkalimetry is described. In this method, free acid is titrated by standard alkali solution after the uranium is masked with ammonium sulfate. After the equivalence point for the free acid appears, hydrogen peroxide is added to the solution and then liberated acid equivalent to uranium is titrated with the same standard alkali solution. Using the proposed method, from 25 mg to 2 grams of uranium and from 0.05 to 30 meq of nitric acid can be readily determined. The method can be used for the determination of nitric, hydrochloric, or sulfuric acid, and uranium, and for the estimation of uranium in tributyl phosphate-kerosine. (auth)

15967 EMISSION SPECTROMETRIC DETERMINATION OF BERYLLIUM IN OILFIELD WATERS USING PLASMA ARC. A. Gene Collins and Cynthia A. Pearson (Bureau of

Mines, Bartlesville, Okla.). Anal. Chem. 36: 787-9(Apr. 1964).

Geochemical studies of the distribution of the constituents of oil-field waters aid in the exploration for petroleum and other minerals, determination of the origin and distribution of oil-field waters and petroleum, location of casing leaks and of water pollution sources. Determination of the beryllium and related data should be useful in these studies. An emission spectrographic method utilizing a plasma arc assembly for determining beryllium in oil-field waters, with a sensitivity permitting detection of less than 1 ppb, was developed. Beryllium was extracted from synthetic and natural oil-field waters with chloroform and acetylacetone. The extracts were aspirated directly into the plasma arc, and the beryllium emission intensity was recorded on photographic plates. (auth)

15968 SYSTEMATIC NEUTRON ACTIVATION TECHNIQUE FOR THE DETERMINATION OF TRACE METALS IN PETROLEUM. Umberto P. Colombo (Montecatini Co., Novara, Italy), Giuseppe Sironi, G. B. Fasolo, and Renzo Malvano. Anal. Chem., 36: 802-7(Apr. 1964).

A systematic neutron activation technique, based on a series of consecutive irradiations and analyses of individual activities was applied to the determination of trace metals in crude oils, distillation fractions, asphalts, and related substances. Analytical procedures are described that allow the determination of traces of V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, Sb, and Au in petroleum products, even when only samples of about 1 gram are available to the laboratory. A detailed description of the experimental method is given, and the data obtained in the analysis of several Italian oils and asphalts are reported. The method does not require ashing of samples under analysis: some metals, such as V, Cr, Mn, Cu, and Sb, are determined directly on irradiated samples, while the other metals are counted after low temperature coking and chemical separation of activities. Serious losses of volatile metal-organic complexes are thus prevented. The different sources of error are discussed. The accuracy of the method is in the order of ±10%. (auth)

15969 DIRECT NONDESTRUCTIVE METHOD FOR DETERMINATION OF CALIFORNIUM-252. APPLICATION OF PROMPT GAMMA RAYS FROM SPONTANEOUS FISSION. Fletcher L. Moore and James S. Eldridge (Oak Ridge National Lab., Tenn.). Anal. Chem., 36: 808-11 (Apr. 1964).

A new direct nondestructive method for the determination of californium-252 is described. The method is based on gamma scintillation spectrometry involving the measurement of prompt γ rays coincident with the spontaneous fission of californium-252. The technique may be used either for the rapid qualitative or quantitative determination of californium-252 in the presence of associated fission products and actinide elements. As little as 10^{-2} nanogram of californium-252 can be quantitatively measured. Several useful analytical and process applications of the method are discussed. (auth)

15970 COMBINED RADIOCHEMICAL–NEUTRON ACTIVATION ANALYSIS METHOD FOR THE DETERMINATION OF SULFUR AND PHOSPHORUS IN HIGH-PURITY PAPER AND BEER. Anthony G. Souliotis (Nuclear Research Center Democritus, Athens, Greece). Anal. Chem., 36: 811-14(Apr. 1964).

Sulfur and phosphorus were evaluated by a mathematical treatment of the specific activities, expressed as ^{32}P, of analyzed materials and of standards after a double irradiation with and without cadmium protection of the targets. After demineralization of the sample by treatment with acid and evaporation of the whole solution to dryness, phosphorus was extracted with ether containing 5% sulfuric acid, and then precipitated as ammonium magnesium phosphate followed by a beta count of ^{32}P. Numerical data were obtained for American and Greek papers and for beers of different types and origin. The sensitivity of this method reaches the value of 10^{-3} ppm for sulfur and phosphorus determinations. (auth)

15971 SIMULTANEOUS DETERMINATION OF MERCURY AND ARSENIC IN BIOLOGICAL AND ORGANIC MATERIALS BY ACTIVATION ANALYSIS. Bernt Sjoestrand (Royal Inst. of Tech., Stockholm). Anal. Chem., 36: 814-19(Apr. 1964).

A method was developed to determine quantitatively nanogram amounts of mercury and arsenic in biological and organic base materials. After neutron irradiation of the sample in a nuclear reactor, followed by a chemical separation based mainly on distillation of volatile compounds of the elements, mercury and arsenic are determined by γ spectrometry. The sensitivity limits are about 5×10^{-4} ppm for mercury and 10^{-3} to 10^{-4} ppm for arsenic when a sample weighing about 0.5 gram is irradiated for 2 to 3 days in a thermal neutron flux of about 10^{12} n/cm^2-second. The samples produced after the chemical separation are usually of high radiochemical purity. It is therefore possible to predict a sensitivity of about 10^{-5} ppm for mercury and 10^{-4} to 10^{-5} ppm for arsenic if the neutron irradiation is performed in a higher flux, say a few times 10^{13} n/cm^2-second, and if certain improvements in the radioactivity measurement technique are introduced. (auth)

15972 INTENSITY RATIO TECHNIQUE FOR X-RAY SPECTROMETRIC ANALYSIS OF BINARY SAMPLES. PARTICULAR APPLICATION TO DETERMINATION OF NIOBIUM AND TIN ON Nb_3Sn-COATED METAL RIBBON. Eugene P. Bertin (Radio Corp. of America, Harrison, N. J.). Anal. Chem., 36: 826-32(Apr. 1964).

X-ray fluorescence spectrometric determinations are usually calibrated with curves of net intensity vs concentration derived from measurements on standards. This technique usually fails when the samples differ from one another or from the standards in surface condition or in the area, shape, or effective thickness exposed in the x-ray spectrometer, and when it is impractical to reproducibly position or orient samples unsuited to masking. For binary systems, this difficulty can sometimes be resolved by measuring the intensity of a line of each component and making a log-log plot of net intensity ratio vs concentration ratio. The curves are linear, and the scatter in the points is reduced. The technique was applied to W-Re and Bi-Sn alloys, to mixtures of Cr_2O_3 and Ag_2O and of Fe_3O_4 and CuO powders, to briquetted Nb-Sn alloy powders, to Nb-Sn coatings on metal ribbons and ceramic plates, and to Ga and In in Ga-In arsenide alloys having constant molar As concentration. (Auth)

15973 IMPROVED TECHNIQUE FOR DETERMINATION OF C^{14} AND H^3 BY FLASK COMBUSTION. Howard P. Baden (Massachusetts General Hospital, Boston). Anal. Chem., 36: 960(Apr. 1964).

Description is given of a new inexpensive combustion and collection system that simplifies the counting of evolved $^{14}CO_2$ and ^3H_2O. With this system 95 to 97% of the C^{14} may be recovered as $^{14}CO_2$ with a 40% counting efficiency. The results with tritium are equally as good with the exception that the counting efficiency is only 10%. The essential feature of the apparatus is the combustion head. The procedure is suited to routine use, and by employing three or four heads a continuous operation may be set up. (P.C.H.)

15974 VAPOR PRESSURE MEASUREMENTS ON THE SYSTEM D_2O-H_2O. ANALYSIS OF D_2O-H_2O MIXTURES. M. Mazurek and A. S. Perlin (National Research Council, Saskatoon, Saskatchewan). Can. J. Chem., 42: 710-11 (Mar. 1964). (NRC-7729)

Thermistors were used to measure vapor pressure in D_2O-H_2O. The general procedure was that devised for molecular weight estimations. Satisfactory resistance readings were obtained with solutions of D_2O at intermediate concentrations in water (5–20% D_2O). The vapor pressure equilibrium process was observed to follow an exponential law, the plot of log ΔR vs time being linear. The concentration of D_2O in the mixture initially can be related directly to the logarithm of ΔR at zero time. (P.C.H.)

15975 COMPLEXOMETRIC DETERMINATION OF CESIUM. Andrzej Cygański (Dept. of Inorganic Chemistry, Politechnika, Lodz, Poland). Chem. Anal. (Warsaw), 9: 103-5(1964). (In Polish)

A complexometric method for the determination of cesium was worked out. The method is based on precipitation of cesium as $Cs_3[Co(No_2)_6] \cdot H_2O$ followed by dissolution of the precipitate in hot solution of HCl (1:1), neutralization of the solution with concentrated ammonia, and complexometric determination of cobalt by titration with 0,01 m EDTA in the presence of NH_4CNS and acetone. (auth)

15976 THE DETERMINATION OF RUBIDIUM AND CESIUM IN STONY METEORITES BY NEUTRON ACTIVATION ANALYSIS AND BY MASS SPECTROMETRY. A. A. Smales, T. C. Hughes, D. Mapper, C. A. J. McInnes, and R. K. Webster (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Geochim. Cosmochim. Acta, 28: 209-33(Feb. 1964).

The rubidium and cesium contents of 12 chondrites were determined independently by neutron activation analysis, and by an isotopic dilution method using mass spectrometry. The close agreement between the results demonstrates that both methods are essentially free from systematic error. The results for these and for a further 12 chondrites, examined by neutron activation only, confirm the wide range reported previously for the distribution of cesium content, and contrast sharply with the uniformity of cesium content claimed by others. In particular, for the same sample of Bluff examined at both laboratories results are: neutron activation 0.0086 ppm, mass spectrometry 0.0088 ppm. New results are listed for a total of 32 samples including 3 carbonaceous chondrites, 2 pallasites, a mesosiderite, and an achondrite. Combining data from this and earlier investigations gives for 24 chondrite falls mean values and ranges of rubidium 2.45 ppm (1.3–3.8 ppm) and cesium 0.073 ppm (0.005–0.2 ppm); this mean cesium value is distinctly lower than the interpolated cosmic abundance of 0.4 ppm, and somewhat lower than a later calculated value of 0.116 ppm. A brief investigation was made of possible fractionation mechanisms based on volatility and the leaching action of water. (auth)

15977 APPLICATION OF ACTIVATION ANALYSIS TO FORENSIC SCIENCE. II. DRUGS. L. C. Bate and M. J. Pro (Oak Ridge National Lab., Tenn.). Intern. J. Appl. Radiation Isotopes, 15: 111-14(Mar. 1964).

Neutron activation analysis was applied to the problem of comparison and identification of drugs. Phenobarbital and pethidine hydrochloride samples were irradiated in the reactor and the resulting induced radionuclides identified by non-destructive γ spectrometry. Results obtained indicate the method could be used in differentiating sources of drugs. (auth)

15978 HIGH PRECISION ABSOLUTE GAS COUNTING OF TRITIUM. I. PREPARATION OF HYDROGEN AND COUNTING GAS. A. Spernol and B. Denecke (Euratom, Geel, Belg.). Intern. J. Appl. Radiation Isotopes, 15: 139-49(Mar. 1964). (In German)

A method for the determination of the activity of tritiated water samples with a reproducibility of 0.1–0.2% and an absolute accuracy of 0.3–0.4% is described in detail. The method of preparation of hydrogen and counting gas from the water sample is given, the construction and operation characteristics of the internal gas counters used are described, and the counting procedure and its errors are discussed. (auth)

15979 RELIABILITY OF MEASUREMENTS OF GROSS BETA RADIOACTIVITY IN WATER. Lloyd R. Setter (Public Health Service, Rockville, Md.). J. Am. Water Works Assoc., 56: 228-36(Feb. 1964).

Encouraging results were obtained in the Analytical Reference Service test for evaluation of gross beta radiation analysis methods with a sample consisting of Cs^{137}. The participating laboratories that used internal proportional counters obtained counting rates that, when converted to activity in picocuries per liter, usually were within 20% of the best estimate. Even when self-absorption factors for mixed fission products were used, the estimates averaged less than 15% higher than the best estimate. The beta activity reported by the laboratories was too frequently in need of correction, because calibration efficiencies were in error or misused. With minor adjustment and additional understanding of counter behavior and characteristics, it is anticipated that gross beta assays by participating laboratories will be entirely satisfactory, and that the assay, currently a tentative one, for α and gross β radioactivity in Standard Methods, will be converted to a standard technique. (auth)

15980 A SIMPLIFIED METHOD FOR Fe^{55} AND Fe^{59} ASSAY IN MIXED PLASMA PREPARATIONS. Ben K. Davis and John A. Koepke (Univ. of Kentucky, Lexington). J. Nucl. Med., 5: 209-12(Mar. 1964).

A method is described for the direct determination of ^{55}Fe and ^{59}Fe in plasma preparations when the two isotopes are used simultaneously in biological tracer studies. Samples of plasma obtained from centrifuged heparinized blood are pipetted directly onto Al planchets, dried, and counted in a gas flow detector with a mylar window of less than 150 $\mu g/cm^2$ average density. The sample is counted again with an Al filter in place. The amounts of ^{55}Fe and ^{59}Fe in the plasma sample can be determined by a simple equation. (C.H.)

15981 SODIUM DETERMINATION IN SILICON AND SILICON DIOXIDE BY GAMMA-RAY SPECTROMETRY. S. Niese (Zentralinstitut für Kernforschung, Bereich Radiochemie, Rossendorf, Ger.). Kernenergie, 7: 105-8(Feb. 1964). (In German)

The γ-spectrometric method for determining the sodium content of silicon and silica is described. It takes into consideration disturbances in the fast-neutron stream caused by the presence of aluminum and magnesium. This is applicable particularly to the fission zone and to the thermal pile of the WWR-S reactor. The feasibility of producing ^{24}Na from silicon is discussed. An experimental procedure is explained and test results are shown. (OTS)

15982 DETERMINATION OF BETA RADIOACTIVITY IN WATER BY COPRECIPITATION AND ION EXCHANGE. E. Tolkendorf (Zentralinstitut fur Kernforschung, Abt. Strahlenschutz und Dosimetrie, Rossendorf, Ger.). Kernenergie, 7: 108-11(Feb. 1964). (In German)

A method for concentrating the content of β-active substances in water is described. It consists in combining coprecipitation (iron hydroxide precipitation) with ion exchange. Wofatite resins are used as ion exchangers, the Cl-form for anions and the H-form for cations. The apparatus through which the water specimen is passed is shown in diagrams. A series of test results indicative of the effectiveness of this method for various types of anions and cations is presented. It is recommended for use with large volumes of water. Hard water can be processed too, if the capacity of the resins is increased using finer grain size. Detergents do not improve the efficiency. (OTS)

15983 IRON DETERMINATION IN PURE ALUMINUM BY ACTIVATION ANALYSIS. O. Grossmann and H.-G. Doege (Institut fur Angewandte Physik der Reinstoffe der Deutschen Akademie der Wissenschaften zu Berlin, Dresden). Kernenergie, 7: 113-16(Feb. 1964). (In German)

A method for determining iron in pure aluminum is described. The iron is completely separated from the base substance and from its other radioactive impurities. The extraction and subsequent purification of the iron, or any other element to be determined, is accomplished by a combination of ion exchange chromatography and carrier precipitation. Sensitivity and reproducibility data for this method are reported and the results of such activation analysis are compared with values of iron content obtained by spectrophotometry. (OTS)

15984 AN EVALUATION OF THE AVAILABLE TECHNIQUES FOR THE AUTORADIOGRAPHY OF TRITIUM ON CHROMATOGRAMS. J. Chamberlain, Alun Hughes, A. W. Rogers, and G. H. Thomas (Univ. of Birmingham, Eng.). Nature, 201: 774-5(Feb. 22, 1964).

The relative merits of various techniques for the autoradiography of tritium on chromatograms are considered, and compared with results obtained by impregnation methods. Sensitivity, reproducibility, and quantitation were evaluated. It was concluded that it is possible to obtain adequate autoradiographs from chromatograms of tritium-labeled compounds by the standard technique of apposition to an x-ray film. This technique is simple, reliable, and permits quantitative estimates of radioactivity to be made, either on eluates from the chromatogram, or by densitometric measurements on the x-ray film itself. (P.C.H.)

15985 DETERMINATION OF MANGANESE-54 IN IRON METEORITE. Yuji Yokoyama and Jacques Labeyrie (Centre National de la Recherche Scientifique, Gif-sur-Yvette, France). Nature, 201: 809-10(Feb. 22, 1964).

Gamma spectrometry was used to determine Mn^{54} in an iron meteorite sample. The gamma spectrometer was composed of 4 in. × 3 in. scinti-block-type NaI(Tl) crystal and a 100-channel pulse-height analyzer. The detector was surrounded by a shield of iron 5 cm thick; 10 cm of lead and 10 cm of paraffin mixed with boron oxide. The spectrometer was placed in an underground room, itself situated beneath a water pool about 1.5 m deep. The Mn^{54} content is estimated as 750 ± 75 dpm/kg. (P.C.H.)

15986 ELECTRON PROBE MICROANALYSIS OF THE LIGHT ELEMENTS. A. Franks (National Physical Lab., Teddington Middx., Eng.). Nature, 201: 913(Feb. 29, 1964).

A vacuum grating spectrometer was developed that allows electron probe microanalysis of light elements. X-rays, excited by an electron beam impinging on the specimen, are analyzed by a vacuum grating spectrometer consisting of a grating and a detector (a windowless electron multiplier) rotatable about a common axis that passes through the grating surface. The spectrometer was designed specifically for use with a microfocus source (approximately 1 μm dia.) and alignment is particularly simple because no collimator slits are required. (P.C.H.)

15987 THE DETECTION OF RADIOISOTOPES IN URINE. [PART] I. K. E. Schulte and G. Henke (Westfälische Wilhelms-Universität, Munster, Ger.). Pharmazie, 18: 529-41(Aug. 1963). (In German)

A review of theory and methods for the detection of isotopes is presented. The evaluation of activity measurements of radionuclides separated from urine, with emphasis on methods of incorporation, rate of resorption, separation after incorporation, and especially differential absorption, is discussed. The choice of samples for measurement is briefly reviewed. Under the topic of total activity of a urine sample, detailed discussion of the influence of K^{40} content on total activity, determination of total activity with detectors for liquids, incineration of the organic substance and separation of K from the urine sample, measurement of total activity by evaluation of solid preparations from the urine sample, detection of radioactive halogens in the determination of total activity, and the application of autoradiography for determination of total activity is made. Tables are presented for the efficiency for various isotopes and the least activity detectable for emitters as measured by a liquid tube counter, a scintillation counter with pan, and scintillation counter with bore hole; data are compared for K^{40}, Cd^{115m}, Sb^{125}, Se^{75}, Cl^{36}, I^{131}, S^{35}, P^{32}, $Sr^{90}-Y^{90}$, Tl^{204}, $Ce^{144}-Pr^{144}$, and Co^{60}. Similar data are given for a methane diffusion counter, a tube counter, and a scintillation counter with β scintillator in measurements on solid samples. Minimum detectable activities by autoradiography are given for Sr^{90} and Se^{75}. A procedure for preparation of samples for determination of total activity by wet oxidation and for the separation of K is outlined. (BBB)

15988 THE DETECTION OF RADIOISOTOPES IN URINE. [PART] II. K. E. Schulte and G. Henke (Westfälische Wilhelms-Universität, Munster, Ger.). Pharmazie, 18: 601-16(Sept. 1963). (In German)

A review of methods for identification and separation of radioisotopes is presented. The characterization of radionuclides of a urine sample by determination of the type and energy of the radiation is discussed. Separation of radioactive cations of urine is reviewed, with particular attention to qualitative separation of isotope mixtures, preparation of the sample for cation separation, and separation of radioactive cations of urine by precipitation of groups. Analysis of the cations in a model sample of urine is tabulated. Great emphasis is placed on the use of paper chromatography of inorganic ions; a general review is given of this topic with emphasis on the separation of radioisotopes. Results are illustrated and R_f values given for various groups with the following ascending solvents: HCl group (Hg(I), Tl(I), Ag, Pb), 10% NH_4OAc; reduction group (Te, Se, Au, Tl(III)), EtOH–2N AcOH, 4 : 1 (vol); H_2S group I (Pb, Cd, Cu, Bi, Hg), tert-BuOH–acetone–H_2O–acetylacetone–HNO_3, 49 : 33 : 10 : 5 : 3 (vol); H_2S group II (Sb, Mo, As, Sn), n-BuOH saturated with 2.16N HCl; urotropine group I (Zr, Ce, Fe), acetone–n-BuOH–HCl(25%), 5 : 5 : 6 (vol); urotropine group II (Cr, V, Be, U), acetone–tert-BuOH–HCl (25%)–acetylacetone, 33 : 43 : 19 : 5 (vol); $(NH_4)_2S$ group (Ni, Mn, Co, Zn), acetone–H_2O–HCl(36%), 87 : 5 : 8 (vol); alkaline earth group (Ba, Sr, Ca), MeOH–HCl(25%)–H_2O, 8 : 1 : 1 (vol); alkali metals (K, Rb, Cs, NH_4), HCl(36%)–MeOH–isobutyl methyl ketone–n-BuOH, 55 : 35 : 5 : 5 (vol). The analytical procedure for these determinations is given. (BBB)

15989 THE DETECTION OF RADIOISOTOPES IN URINE. PART III. K. E. Schulte and G. Henke (Westfälische Wilhelms-Universität, Munster, Ger.). Pharmazie, 18: 684-98(Oct. 1963). (In German)

Evaluation of paper chromatograms of inorganic ions by measurement of activity with a Geiger-Müller tube and by autoradiography is outlined. Photographs of radiometric determinations for the fractions from treatment of urine with HCl, reduction, H_2S I, H_2S II, urotropin I, urotropin II, and $(NH_4)_2S$ and the alkaline earth, and alkali metal groups are included. Quantitative determination of nuclides on the paper chromatogram is reviewed and applied to the problem of urine analysis; the recovery in a model system ranges from 84 to 96%. Identification of γ emitters in solutions of the above groups may be made by scintillation spectroscopy. The γ spectra of Co^{60}, I^{131}, Se^{75}, Ce^{144}, Cs^{137}, and Sb^{125} solutions measured by this procedure are shown. The separation of radioactive anions is discussed; the use of precipitants is reviewed. A procedure for the quantitative determination of radioactive anions in a urine sample allows separation and estimation of Cl^{36}, I^{131}, S^{35}, and P^{32}. Determination of Cl^{36} and I^{131} in the presence of each other is made by analysis of the decay curve of the Ag halide sample. One hundred sixty-two references are cited for this article and the two preceding in the series. (BBB)

15990 AMPEROMETRIC TITRATION OF THORIUM WITH TWO PLATINUM ELECTRODES DETERMINATION OF THORIUM CONTENT IN URANINITE. I. A. Tserkovnitskaya and Ju-chiu Yeh. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 168-71(1963). (In Russian)

For determination of thorium content in uraninite the amperometric means, using the indicator system of Fe_{III} EDTA–Fe EDTA, was suggested. (auth)

15991 THE SPECTRAL DETERMINATION OF SMALL QUANTITIES OF HAFNIUM AND THORIUM IN NATURAL MATERIALS. M. N. Smirnova and T. M. Moroshkina. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 172-3(1963). (In Russian)

A method for the direct spectral determination of small quantities of Hf and Th in ores and minerals was suggested. It enables one to determine these elements in natural samples containing no less than 0.001% of Hf or 0.0005% of Th. (auth)

15992 RADIOKHIMICHESKII ANALIZ. (Radiochemical Analysis). A. K. Lavrukhina, T. V. Malysheva, and F. I. Pavlotskaya. Moscow, Publishing House of the Academy of Sciences, 1963. 220p.

The state and behavior of radioelements in solution, the theoretical basis of methods for radiochemical analysis, methods for identifying radioisotopes, and the separation and concentration of radioisotopes are discussed. Over 1500 references are listed. (C.E.S.)

15993 APPLICATION OF $B^{10}(n,\alpha)Li^7$ REACTION TO THE DETERMINATION OF BORON IN SILICON. V. I. Zvyagin, E. M. Lobanov, B. P. Zverev, and V. M. Lenchenko. p.56-67 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Boron was determined in silicon by placing p-n silicon in a thermal neutron flux and applying the following formula: $N = n/\sigma I V_{eff} \Theta$, where N is boron concentration, n is the number of alpha pulses recorded per sec, I is the neutron flux $cm^{-2} \cdot sec^{-1}$, σ is the $B^{10}(n,\alpha)$ cross section in barns, V_{eff} is the effective reaction volume, and Θ is the B^{10} concentration (in a natural mixture $\Theta = 0.185$). (R.V.J.)

Inorganic and Physical Chemistry

15994 (AD-416506) MOBILITY OF Li^+ IN He AT HIGH TEMPERATURES. Guenter G. Weber (Yale Univ., New Haven). [1963]. Contract AF18(603)-15. 21p.

Some models for the Li^+–He reaction and some previous calculations on Li^+–He and He–He reactions are reviewed, and the interaction energy for Li^+–He is calculated by the δ-function model. Comparison with measurements on the He–He reaction shows that the right order of magnitude is obtained. Vibrational and rotational states are also briefly considered. (D.C.W.)

15995 (K-271) VAPOR-LIQUID EQUILIBRIUM OF THE URANIUM HEXAFLUORIDE–DECAFLUOROBIS-(TRIFLUOROMETHYL) CYCLOHEXANE, C_8F_{16}, SYSTEM. James L. Gabbard, S. Bernstein, and E. S. Amis (Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.). Sept. 27, 1948. 24p.

The vapor-liquid equilibrium of the uranium hexafluoride–decafluorobis(trifluoromethyl)cyclohexane system was studied at approximately 40 psia in a metal Othmer-type equilibrium still. Samples of the system covering the entire concentration range were investigated. Diagrams showing vapor-liquid equilibrium, and vapor-liquid temperature-composition were experimentally determined, and are compared graphically with the theoretical diagrams. The relative volatility of the two components of the system was calculated and is shown graphically. The activity coefficients of the two components were calculated in terms of deviation factors from Raoult's Law are treated graphically as suggested by Carlson and Calburn. The minimum number of theoretical plates necessary for separation of the two components is presented. (auth)

15996 (NBS-MON-68) COMPILATION OF THE MELTING POINTS OF THE METAL OXIDES. Samuel J. Schneider (National Bureau of Standards, Washington, D. C.). Oct. 10, 1963. 32p.

A compilation was made of the melting points of 70 metal oxides published prior to January 1963. Both the original melting point and the equivalent value based on the International Practical Temperature Scale of 1948 are presented. Included in the survey is information on pertinent experimental details such as the method of temperature measurement, purity, furnace type, and environmental conditions. (auth)

15997 (RT/CHI(63)-32) RIDUZIONE CATALITICA DELL'URANIO ESAVALENTE MEDIANTE ACIDO FORMICO. (Catalytic Reduction of Hexavalent Uranium by Formic Acid). G. Cogliati, R. Lanz, and C. Lepscky (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). Oct. 1963. 14p.

The catalytic reduction of U(VI) to U(IV) by means of formic acid has been studied, considering particularly the uranyl nitrate solutions. This process will be applied in the urania–thoria mixed fuel reprocessing plant, (PCUT). Various catalysts have been tested and the influence of formic acid concentration, temperature and catalyst concentration on the reaction rate have been determined. A possible reduction mechanism coherent with the experimental data is discussed. (auth)

15998 (TID-7688(p.52-63)) MEASUREMENT OF DIFFUSIVITY IN A HIGH VISCOSITY LIQUID. Martin V. Hollander and James J. Barker (New York Univ., New York).

A rapid method of measuring molecular diffusivities in viscous systems, based on monitoring a radioactive tracer during the transient phase of operation of a diaphragm cell, was developed and used to measure the diffusivity of NaCl in glycerol at 32°C as $18.36 \pm 0.36 \times 10^{-6}$ cm^2/sec. The experimentally determined diffusivity is considerably larger than the value indicated by the Stokes-Einstein equation. The ease of the method should stimulate further applications to other viscous systems, which may lead to a better understanding of the liquid state. (auth)

15999 (TID-7689(p.93-5)) THE USE OF S^{35} FOR INVESTIGATION OF ISOTOPIC EXCHANGE REACTIONS OF ELEMENTAL SULFUR. Charles W. Owens and F. S. Rowland (New Hampshire. Univ., Durham and Kansas. Univ., Lawrence).

The exchange reactions between elemental sulfur and sulfur-containing molecules were studied using ^{35}S-labeled compounds. (M.C.G.)

16000 (TID-7689(p.96-103)) USE OF ISOTOPES IN RING AND LINEAR VACUUM DISTILLATION SOURCE STUDIES. C. Bugenis and Luther E. Preuss (Henry Ford Hospital. Edsel B. Ford Inst. for Medical Research, Detroit).

Film profiles from a single ring vapor source and a single line source were studied over extended regions of substrate. The radiotracer technique was employed in order to measure films in the range of several angstroms to less than a monolayer. The experimental technique consisted of preparation of vapor sources, charging the sources with neutron-irradiated gold foil, melting and evaporating the gold under high vacuum, condensing the gold on a narrow strip substrate along some axis of symmetry, assaying the substrate for film density profile, and comparing the experimental profile with the theoretical prediction. In the case of the ring source, the experiment verified theoretical prediction that optimum uniformity of deposit occurs at the source elevation to source radius ratio of 1.1. However, quantitatively the film density was higher than predicted. In the case of the linear source, the experimental results indicated that the deposit density becomes more uniform as the source elevation to source length ratio increases from 1 to 10, agreeing with theoretical prediction. However, the quantitative results again indicated a heavier deposit than theoretical prediction. (M.C.G.)

16001 (TID-7689(p.126-8)) FREQUENCY RESPONSE TESTING OF AQUEOUS MIXING SYSTEMS BY A RADIOTRACER PULSE TECHNIQUE. R. P. Gardner, L. F. Ballard, and J. K. Ferrell (North Carolina State Coll., Raleigh).

Determining the frequency response of aqueous mixing systems by a radiotracer pulse technique is described and advantages of the method are listed. The method consists of injecting a radiotracer into the system as an impulse and monitoring the output pulse with suitable digital detection equipment. Data obtained in this manner are used to calculate the frequency response of the system by use of a digital computer program. (M.C.G.)

16002 (TID-7689(p.133-6)) RESIDENCE TIME OF PARTICLES IN A ROTARY KILN. B. A. Fries (Californja Research Corp., Richmond).

Tracer techniques were used for studying the residence time of particles, −7 to +8 mesh size, in a rotary kiln. The kiln was serving as a cooler in the manufacture of inorganic fertilizer pellets. The tracer chosen was 15-hr ^{24}Na. Results are presented in graph form. The median residence times in two tests were 16.5 and 16.0 min. (M.C.G.)

16003 (TID-7689(p.136-7)) TRACER STUDIES OF IMPURITY-DOPED OXIDE CATHODES. James K. Lee (Radio Corp. of America. Television Picture Tube Div., Marion, Ind.).

A radioactive tracer technique, using ^{114}In, was used in a study of the effect of the addition of elementary indium on the semiconducting property and the thermionic emission capability of an oxide cathode coating. It was found that the logarithm of conductivity is linearly related to the reciprocal of absolute temperature and that the conductivity of the cathode coating increased with increased impurity concentration in the semiconducting region from room temperature to 1300°K. (M.C.G.)

16004 (TID-20339) THE ROTATING DISK ELECTRODE: EFFECT OF RATES OF ROTATION AND POLARIZATION. Report No. 82. Ilana Fried and Philip J. Elving (Michigan. Univ., Ann Arbor). Feb. 21, 1964. Contract AT(11-1)-1148. 21p.

The rotating disk electrode was used to investigate (a) the relationship between the thicknesses of the diffusion and hydrodynamic diffusion (Levich) layers, and (b) its influence on the mode of mass transport, which controls the electrode process. The oxidation of ferrocyanide in chloride solution on wax-impregnated graphite was the experimental system used. Experiments at slow rotation speeds and fairly fast polarization rates show current peaks rather than plateaus, indicating that the mode of mass transport of the electroactive species to the electrode surface is determined not only by whether the electrode is rotated or not, but also by the relative magnitudes of the speed of rotation and of the rate of polarization. Theoretical explanation of this phenomenon is given. (auth)

16005 (TID-20354) SOLID-LIQUID INTERFACE. Progress Report, June 6, 1963–June 5, 1964. Che-Yu Li (Cornell Univ., Ithaca, N. Y.). Mar. 12, 1964. Contract AT(30-1)-3228. 6p.

Experiments are in progress to study the morphological changes governed by capillarity on interfaces between a solid and liquid electrolyte and between a solid and liquid metal. The electrical conductivity of thin film solid electrolyte in contact with liquid electrolytes of different compositions is being measured to reveal the defect structure in the solid near the interface. (auth)

16006 (UCRL-11124) VAPOR PRESSURE AND HEAT OF SUBLIMATION OF BARIUM FLUORIDE (thesis). Patrick E. Hart (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 16, 1964. Contract W-7405-eng-48. 20p.

The vapor pressure of barium fluoride was measured in the temperature range 1261 to 1548°K by the torsion-effusion method. The vapor pressure of barium fluoride in atmospheres is given by the expression $\{\log P = -[(78.70/45.76) \pm 1.42] \times (10^4/T) + 6.94 \pm 0.23\}$ where the quoted errors are the standard deviation from the least-squares fit. Extrapolation of the data yields a heat of sublimation at 298°K of 90.29 ± 2 kcal/mole by the third-law method and 87.06 ± 1.45 kcal/mole by the second-law method. (auth)

16007 (AEC-tr-6377) THERMAL DISSOCIATION OF AMMONIUM POLYURANATE (ADU). H. Landspersky', I. Imrisova, L. Sedlakova, and Z. Urbanec (Československá Akademie věd. Ustav Jaderného Výzkumu, Rež). Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from report UJ-929/63, 1963. 18p.

Changes in reflection spectra of ADU after hydration and drying, the effect of ADU calcination on the surface area of intermediate UO_3 and final UO_2, and phase transitions during thermal treatment were studied. No direct relations between reflection spectra, chemical composition, and conditions of ADU preparation were found. During ADU calcination, $\beta-UO_3 + UO_3$ amorphous was formed and surface area increased up to 350°; at higher temperatures sintering occurred. The sintering mechanism of UO_3 powders between 350 and 600° was controlled by the diffusion rate on the surface of particles. The ratio $\beta-UO_3 : UO_3(A)$ depended on preparation conditions. Surface area of UO_2 prepared from UO_3 calcined at 350° was twice as great as that of UO_2 reduced from ADU. The degree of ADU calcination could be compared by the help of reflection spectra. (auth)

16008 (ORNL-tr-31) FUSIBILITY DIAGRAM FOR THE $NaF-KF-ZrF_4$ TERNARY SYSTEM. I. N. Sheiko, V. S. Kikhno, and V. I. Mel'nikov. Translated by C. B. Finch (Oak Ridge National Lab., Tenn.), from Ukr. Khim. Zh., 29: 1259-64(1963). 8p.

The fusibility diagram of the $NaF-KF-ZrF_4$ ternary system was examined using visual polythermal and DTA methods. It was established that the liquidus surface in the $NaF-KF-ZrF_4$ system has eight crystallization fields: ZrF_4; $Na_3Zr_4F_{19}$; $KZrF_5-Na_7Zr_6F_{31}$ ss; $K_2ZrF_6-Na_2ZrF_6$ ss; $Na_5Zr_2F_{13}$; $K_3ZrF_7-Na_3ZrF_7$ ss; NaF; KF. The possibility for formation of a compound $KNaZrF_6$ was predicted on the basis of an x-ray pattern of a sample of this composition. (auth)

16009 CONTRIBUTION TO THE STUDY OF HYDRATED URANIUM OXIDES. J. Protas (Laboratoire de Minéralogie-Cristallographic, Paris). Bull. Soc. Franc. Mineral. Crist., 82: 239-72(1959). (In French)

Hydrated uranium oxides can be precipitated by reaction in aqueous solution of uranyl salts and salts of calcium, strontium, barium, lead, and bismuth at variable temperatures, generally between 100 and 180°C. In this manner, schoepite $U_4O_9(OH)_8 \cdot 5H_2O$, becquerelite $CaU_6O_{18}(OH)_8 \cdot 8H_2O$ billietite $BaU_6O_{16}(OH)_8 \cdot 8H_2O$, curite $PbO \cdot 8UO_3 \cdot 5H_2O$, fourmarierite $PbO \cdot 4UO_3 \cdot 5H_2O$, vandendriesscheite $PbO \cdot UO_3 \cdot 12H_2O$, uranospherite $UO_4Bi(OH)$, and other compounds not found in nature were prepared. The physical (density, optical properties, and crystallographic properties) and chemical characteristics and the principal deposits were given for each species. The study of typical samples from different deposits permitted the description of two new minerals. One was a complex hydrated oxide of uranium, calcium, and lead coming from a French deposit of Margnac II. The other was a hydrated double oxide of uranium and lead wolsendorfite $(Pb,Ca)U_2O_7 \cdot 2H_2O$ from the Wolsendorf (Bavaria) deposit and confused up to the present with fourmarierite. Data on the genesis and descendency of various minerals studied were given in connection with synthesis experiments. (tr-auth)

16010 COMPUTATIONAL METHOD ESTIMATING THE EVOLUTION IN TERMS OF PERCOLATION RATE, OF THE PERCOLATION INJECTED IONS IN POROUS MEDIA. M. Bourrier (Centre de Recherches et d'Experimentation du Genie Rural, Antony, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 85-94(1963). (In French)

Owing to complexity of phenomena controlling the retention in porous media, a simple assumption relative to ion-exchange between a liquid mobile phase and a solid stationary phase taking into account the displacement rate in the liquid phase is suggested. It is assumed that in all the media points the number of ions that pass during a unit of time from one phase to the other is proportional to the volumic density of ions in this phase. By taking into account the mean rate of liquid phase in porous media, equations were obtained. (P.C.H.)

16011 KINETICS OF ALPHA-UO_3 DISSOCIATION. V. G. Vlasov and A. R. Beketov. Izv. Akad. Nauk. SSSR, Otd. Tekhn. Nauk, Met. i Gorn. Delo, No. 6, 110-15(Dec. 1963).

An experimental study was made on the kinetics of dissociation of hexagonally modified uranium trioxide, alpha-UO_3, as this dissociation is a characteristic example of a continuous reaction. The experiments were performed in a vacuum and at pressures up to 150 mm Hg in the temperature interval 525-600°C. Quantitative measurements of the high rate of dissociation at the start of the reaction and gradual lessening of reaction rate as the composition changed to U_3O_8 were made and related to the temperature and pressure. X-ray analysis was used to determine structure and phase distributions in the solid solutions of UO_3 and U_3O_8. The observed relationship between the apparent activation energy and the degree of dissociation is discussed, as well as the effect of the reaction on the electrical resistance. (OTS)

16012 SOLUBILITY OF URANIUM PEROXIDE. A. V. Nikolaev and S. A. Durasova (Inst. of Inorganic Chemistry, Siberian Branch, Academy of Sciences, Norosibirsk). Izv. Sibirsk. Otd. Akad. Nauk SSSR, No. 3, 9-13(1963). (In Russian)

The solubility of uranium peroxide ($UO_4 \cdot 2H_2O$) in water was determined at 25, 40, 60, and 100°C and showed an increase from 4.9 to 6.0 mg/l. The solubility of UO_4 in H_2SO_4 was also studied at various pH's at the above temperatures; it exhibited a greater dependence on the temperature. The solubility increased greatly with reduced pH, and at 100°C and pH = 1 it reached 10.7 g/l. Studies of the effects of H_2O_2 concentration on the solubility of UO_4 in H_2SO_4 indicated that additions of 0.2 mole/l H_2O_2 sharply reduced the solubility of UO_4. (tr-auth)

16013 CRYSTAL-CHEMICAL STUDIES OF RARE EARTH FLUORIDES. L. R. Batsanova (Inst. of Inorganic Chemistry, Siberian Branch, Academy of Sciences, Novosibirsk). Izv. Sibirsk. Otd. Akad. Nauk SSSR, No. 3, 83-9 (1963). (In Russian)

X-ray and optical analyses were made at various temperatures of ammonium lanthanide fluorides, and their composition was determined. A comparison of the crystal and chemical properties of the rare earth trifluorides prepared by decomposition of the mixed fluorides at 600° with the properties of the products treated at high temperatures showed that heating affected the optical properties of rare earth fluorides. Moreover, an increased temperature induced and amplified the optical anisotropy and variations of the absorption band intensity in the infrared region. Densities and refractive indices for rare earth and yttrium fluorides are tabulated. (tr-auth)

16014 IONIC CONDUCTIVITY OF CUBIC SOLID SOLUTIONS IN THE SYSTEM $CaO-Y_2O_3-ZrO_2$. D. W. Strickler and W. G. Carlson (Westinghouse Research Labs., Pittsburgh). J. Am. Ceram. Soc., 47: 122-7(Mar. 21, 1964).

The ionic conductivity of cubic solid solutions in the system $CaO-Y_2O_3-ZrO_2$ was examined. Particular $Y_2O_3-ZrO_2$ binary compositions were more conductive at elevated temperatures (>600°C) than either $CaO-ZrO_2$ binary or $CaO-Y_2O_3ZrO_2$ ternary compositions. The higher ionic conductivity appears to be related to a lower activation energy rather than to the number of oxygen vacancies dictated by

composition. The compositions of highest conductivity lie close to the cubic-monoclinic solid-solution phase boundary. Conductivity-temperature data are presented that indicate a reversible order-disorder transition for Y_2O_3-ZrO_2 cubic solid solutions containing 20 and 25 mole % Y_2O_3. The transference number for the oxygen ion at 1000°C for Y_2O_3-ZrO_2 cubic solid solutions is greater than 0.99. (auth)

16015 PREPARATION AND CRYSTALLOGRAPHIC PROPERTIES OF A^{2+} B_2^{3+} O_4 TYPE CALCIUM AND STRONTIUM SCANDATES. J. R. Carter and R. S. Feigelson (Sperry Rand Research Center, Sudbury, Mass.). J. Am. Ceram. Soc., 47: 141-4(Mar. 21, 1964).

The compounds $CaSc_2O_4$ and $SrSc_2O_4$ were synthesized by solid-state reaction of the component oxides at temperatures ranging from 950 to 1400°C. Both calcium and strontium monoscandates are orthorhombic and analogous to $CaFe_2O_4$. Lattice parameters for $CaSc_2O_4$ are a_0 = 9.461, b_0 = 11.122, c_0 = 3.143, and for $SrSc_2O_4$, a_0 = 9.698, b_0 = 11.302, c_0 = 3.185. Based on four molecules per unit cell, the x-ray density for $CaSc_2O_4$ is 3.89 and that for $SrSc_2O_4$ is 4.59 g per cm^3. (auth)

16016 THE VAN DER WAALS RADII OF GASEOUS IONS OF THE NOBLE GAS STRUCTURE IN RELATION TO HYDRATION ENERGIES. R. H. Stokes (Univ. of New England, Armidale, Australia). J. Am. Chem. Soc., 86: 979-82 (Mar. 20, 1964).

In comparing experimental free energies of hydration of ions with calculations from electrostatic models, the self energy of the gaseous ion is the dominant term. The crystal radius is not appropriate for the calculation of this term. The van der Waals radius calculated from that of the isoelectronic noble gas by the quantum mechanical scaling principle is a reasonable alternative and leads to excellent agreement with the experimental data for ions of the noble gas structure. The model used for the ion in solution is consistent with the known dielectric properties of water. (auth)

16017 CRYSTAL LATTICE ENERGIES AND THE ELECTROSTATIC SELF ENERGIES OF GASEOUS IONS. R. H. Stokes (Univ. of New England, Armidale, Australia). J. Am. Chem. Soc., 86: 982-6(Mar. 20, 1964).

The self energies of gaseous ions, calculated from their van der Waals radii show a striking correlation with crystal lattice energies. For ions of the noble gas electronic structure, the lattice energy of a crystal in which the cations and anions have equal van der Waals radii is simply the negative of the self energy of the gaseous ions. For ions of unequal size, the difference between these two energies is a linear function of the radius ratio of the gaseous ions; a single slope characterizes large groups of crystals. A tentative explanation of these observations is suggested in terms of a simple electrostatic model taking account of the deformation of the ions in the crystal. (auth)

16018 KINETICS OF THE REDUCTION OF SOME COBALT(III) COMPLEXES BY CHROMIUM(II), VANADIUM(II), AND EUROPIUM(II). John P. Candlin, Jack Halpern, and David L. Trimm (Univ. of Chicago). J. Am. Chem. Soc., 86: 1019-22(Mar. 20, 1964).

Kinetic measurements are reported on the reduction of a variety of pentaamminecobalt(III) complexes by Cr^{2+}_{aq}, V^{2+}_{aq}, Eu^{2+}_{aq}, and $Cr(bipy)_3^{2+}$ (bipy = 2,2′-bipyridine). The resulting reactivity patterns were examined from the standpoint of providing a possible basis for distinguishing between inner- and outer-sphere electron-transfer mechanisms. The variation in rate, with V^{2+} as reductant, was found to be much smaller than with Cr^{2+} and to exhibit sufficient similarity to the variation in rate observed with $Cr(bipy)_3^{2+}$ (as well as with the rates of electrochemical reduction of the corresponding cobalt(III) complexes at a dropping mercury electrode) to suggest that both V^{2+} and $Cr(bipy)_3^{2+}$ react through outer-sphere mechanisms. These correlations also contribute to the confirmation of an important prediction of the Marcus theory of electron transfer. The reactivity of Eu^{2+} toward the halopentaamminecobalt(III) complexes was found, in contrast to the other reductants, to decrease in the order $Co(NH_3)_5F^{2+} > Co(NH_3)_5Cl^{2+} > Co(NH_3)_5Br^{2+} > Co(NH_3)_5I^{2+}$, a trend that was interpreted in terms of an inner-sphere mechanism. The rates of reaction of Cr^{2+}, V^{2+}, and Eu^{2+} with $Co(NH_3)_5PO_4$ all exhibited a marked pH dependence that was interpreted in terms of the protonation equilibria of the complex. (auth)

16019 PROTON MOBILITY AND ELECTRON EXCHANGE IN AQUEOUS MEDIA. R. A. Horne and E. H. Axelrod (Arthur D. Little, Inc., Cambridge, Mass.). J. Chem. Phys., 40: 1518-22(Mar. 15, 1964).

Evidence from several different sources is cited in support of the hypothesis that the iron (II)–(III) electron-exchange reaction involves a Grotthuss-type mechanism closely related to that responsible for the anomalous mobility of protons in aqueous solution. This evidence includes failure of the electron exchange to occur in the absence of water, similarity of the two processes with respect to the deuterium isotope effects, similarity of rate ratios in liquid water and ice, and similarity of activation energies of the two processes and of their temperature dependence. (auth)

16020 THERMAL CONDUCTIVITIES OF GASEOUS H_2O, D_2O, AND THE EQUIMOLAR H_2O–D_2O MIXTURE. Charles E. Baker and Richard S. Brokaw (Lewis Research Center, Cleveland). J. Chem. Phys., 40: 1523-8(Mar. 15, 1964).

Measurements were carried out over the temperature range 380–525°K using a four-cell hot-wire thermal-conductivity apparatus. At the lower temperatures the thermal conductivities of H_2O and D_2O are identical, but at the highest temperature the conductivity of D_2O is larger by 8–9 parts per thousand. Conductivities of the equimolar mixtures lie midway between the conductivities of the pure components. Results are analyzed to test a recent hypothesis that a resonant exchange of rotational quanta causes the thermal conductivity of a polar gas to seem anomalously low in relation to its viscosity. It was concluded that the interchange of rotational energy between neighboring dipoles may be important, but that exact resonance is probably not required, at least in the case of water vapor. (auth)

16021 INFRARED SPECTRA OF ICES Ih AND Ic IN THE RANGE 4000 TO 350 cm^{-1}. J. E. Bertie and E. Whalley (National Research Council, Ottawa). J. Chem. Phys., 40: 1637-45(Mar. 15, 1964).

The infrared spectra of Ice Ih made from H_2O, D_2O, a mixture of 95% H_2O and 5% D_2O, and a mixture of 5% H_2O and 95% D_2O, and of Ice Ic made from H_2O, D_2O, and a mixture of 95% H_2O and 5% D_2O, were recorded in the region 4000 to 350 cm^{-1} using low-temperature mulling techniques. The Ice Ic was made by transformation of Ices II and III, and was authenticated by its x-ray diffraction powder pattern. The spectra of Ices Ih and Ic are identical within experimental error. The spectra of Ice Ih, while similar in their main features to those reported by others, differ significantly in detail, probably largely because much of the previous work, particularly on D_2O ice, was done with partly vitreous ice. The usual interpretation of the bands

in terms of the ν_1, ν_2, ν_3, and ν_R vibrations of isolated molecules is greatly oversimplified because intermolecular coupling is important. There are at least six (five infrared and one Raman) bands due to O–D stretching vibrations in the spectrum of D_2O Ice I, but the detailed origin is unknown. The breadth of the O–H and O–D stretching bands of HDO in dilute solution in D_2O and H_2O is interpreted as indicating a disarrangement of the oxygen positions due to the disorder of the hydrogen atoms. (auth)

16022 INFRARED SPECTRA OF ICES II, III, AND V IN THE RANGE 4000 TO 350 cm^{-1}. J. E. Bertie and E. Whalley (National Research Council, Ottawa). J. Chem. Phys., 40: 1646-59(Mar. 15, 1964).

The infrared spectra of Ices II, III, and V between 4000 and 350 cm^{-1} were obtained. The ices were made at appropriate pressure and temperatures, cooled under pressure to liquid-nitrogen temperature, and removed from the pressure vessel. Mulls were made near liquid-nitrogen temperature using isopentane or perfluoropropane as mulling agents, and the spectra of the mulls at ~ 100°K were recorded. The spectra of ices made from H_2O, D_2O, 5% H_2O in D_2O, 5% D_2O in H_2O, and, for Ices II and III, 1% D_2O in H_2O were obtained. In general features, the spectra of pure H_2O and D_2O Ices II, III, and V are similar to those of Ice I. For most bands there is a shift of frequency from that in Ice I towards the vapor frequencies, but the shift is small compared with the shift between Ice I and the vapor. Ices II, III, and V are therefore essentially fully hydrogen bonded and are probably four coordinated. This agrees with a proposed structure for Ice III. In Ices II and III the bands due to the O–H and the O–D stretching vibrations of HDO in dilute solution in D_2O and H_2O, respectively, show a good deal of fine structure, and are quite narrow, the half-width of the O–D bands being about 5 cm^{-1}. These are by far the sharpest O–H (or O–D) stretching vibrations of hydrogen-bonded O–H---O groups so far observed. Clearly, breadth is not inherent in the O–H stretching bands of O–H---O. There is also a good deal of fine structure in the bands due to rotational vibrations of water molecules in Ices II and III, and much of this fine structure broadens and weakens when a small amount of H_2O is added to D_2O, and of D_2O to H_2O. The only simple explanation of this, and of the fine structure of the O–H stretching bands, is that the hydrogen atoms in Ices II and III are ordered. No corresponding fine structure occurs in Ice V, and the hydrogen atoms are probably disordered, as in Ice I. (auth)

16023 RAMAN SPECTRA OF ICES Ih, Ic, II, III, AND V. M. J. Taylor and E. Whalley (National Research Council, Ottawa). J. Chem. Phys., 40: 1660-4(Mar. 15, 1964).

The Raman spectra at 77°K of Ices Ih, Ic, II, III, and V made from H_2O and D_2O were obtained. The spectra in the O–H and O–D stretching region were obtained both photographically and photoelectrically using Hg 4358 Å as the exciting radiation, and the low-frequency spectra were obtained photographically using Hg 2537 Å as the exciting radiation. In the O–H stretching region, the spectra of ices Ih and Ic are identical, and the spectra of Ices II, III, and V are similar except that the frequencies are higher than in Ice I. Ices II, III, and V appear to be essentially fully hydrogen bonded, as was concluded from the infrared spectra. In the low-frequency spectrum there is one band or sometimes two bands in all the Ices, and they are probably due to translational vibrations of the molecules. (auth)

16024 STATISTICAL MODEL INCLUDING ANGULAR MOMENTUM CONSERVATION FOR ABNORMAL ROTATION OF OH* SPLIT FROM WATER. Tadao Horie and Takashi Kasuga (Osaka Univ.). J. Chem. Phys., 40: 1683-6 (Mar. 15, 1964).

In order to give an account of extreme, nonthermal populations of the rotational states of the $^2\Sigma^+$ level of OH split by electron impact from water, a proposal is made for a statistical model that includes the law of angular momentum conservation within it. The interaction volume is taken to be double-walled and spherically symmetric with respect to the center of gravity of the whole system, which consists of OH* and H. It is shown that abnormal populations quite similar to typical ones thus far experimentally observed can be derived from the model proposed with the aid of the Franck-Condon principle and a predissociation of OH. (auth)

16025 PRESSURE-INDUCED SHIFTS OF DCl LINES DUE TO HCl: SHIFT OSCILLATION. J. H. Jaffe, M. A. Hirshfeld, and A. Ben-Reuven (Weizmann Inst. of Science, Rehovoth, Israel). J. Chem. Phys., 40: 1705-6(Mar. 15, 1964).

Pressure-induced shifts of DCl lines (2-0 band) due to HCl were observed. In addition to the expected J dependence there is a striking oscillation from line to line of the magnitude of the shift. It is suggested that this phenomenon is due to near-resonant dipole interactions between HCl and DCl. (auth)

16026 CONSIDERATION OF "SPHERICAL HOT SPOTS" ARISING FROM PION CAPTURE IN EXPLOSIVES USING THERMAL INITIATION THEORY. Joseph Cerny and J. V. Richard Kaufman (Picatinny Arsenal, Dover, N. J.). J. Chem. Phys., 40: 1736-44(Mar. 15, 1964).

The process whereby relatively high energy density, spherical zones of radiation heating may arise from slow π^--meson irradiations is described, and the effects of such microscale hot spots on six explosives (lead azide, lead styphnate, mercury fulminate, RDX, TNT, and PETN) was investigated. No explosions or signs of thermal decomposition were observed with any of the explosives. Analysis of these results by the hot-spot model of explosive initiation and thermal growth was attempted. The conclusions were: that this model can not explain the experimental results observed for RDX, in that it predicts initiation, and that the previous experiments attempting explosive initiation by the microscale thermal effects of ionizing radiation have not investigated those explosives most susceptible to initiation by this mechanism. (auth)

16027 EFFECTS OF ELECTRON TRANSFER ON HIGH-RESOLUTION NMR SPECTRA. Charles S. Johnson, Jr. and John C. Tully (Yale Univ., New Haven). J. Chem. Phys., 40: 1744-50(Mar. 15, 1964).

The 15.1-Mc/sec NMR spectra of isopropylquinone and 2,5-diethoxyquinone in equilibrium with the corresponding semiquinone radicals in pyridine show line positions and intensities that depend on the radical concentrations. These spectra are compared with curves calculated by the density matrix technique with the assumption that modulated isotropic hyperfine interactions provide the only relaxation mechanism. Satisfactory agreement was found for the methyl protons in isopropylquinone from which it was estimated that $T_1 > 100T_2$ for the methine protons; however the line shapes for the methyl protons in 2,5-diethoxyquinone suggest that other relaxation mechanisms may be present. (auth)

16028 DISCONTINUOUS CHANGE OF BINDING TYPE IN THE SERIES OF MONOHYDRIDES. Kasimir Fajans

(Univ. of Michigan, Ann Arbor). J. Chem. Phys., 40: 1773-5(Mar. 15, 1964).

Discontinuous change of quantization, of the kind of subdivision of the electronic system into quantized groups, in the series of the hydrides LiH to HF is discussed. Such a change is considered on the basis of the quanticule theory of chemical binding. (P.C.H.)

16029 A SPECTROPHOTOMETRIC STUDY OF THE NITRATE COMPLEXES OF URANIUM(IV). H. A. C. McKay and J. L. Woodhead (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc.: 717-23 (Feb. 1964).

The spectra of 0.014M-uranium(IV) solutions in various nitrate–perchlorate media were determined at 20 ± 2°C. Isosbestic points observed in different concentration ranges indicate four basic spectra from which the intermediate spectra are compounded. These were identified as due to (i) U^{4+}, (ii) UOH^{3+}, (iii) UNO_3^{3+}, $U(NO_3)_2^{2+}$ ... etc. (this group give essentially the same spectrum), and (iv) $H_2U(NO_3)_6$. Equilibrium constants for the hydrolysis and nitrate complex-formation of U^{4+} were determined; those for nitrate complex-formation vary considerably with the total salt concentration in the range 1–4M. (auth)

16030 THERMAL STUDY OF THE TUNGSTEN BRONZES. I. HEAT CAPACITY OF $Na_{0.679}WO_3$ IN THE RANGE 15–300°K. B. C. Gerstein, A. H. Klein, and H. R. Shanks (Iowa State Univ., Ames). J. Phys. Chem. Solids, 25: 177-82(Feb. 1964).

The heat capacity of $Na_{0.679}WO_3$ was measured in the range 15–300°K. The Debye temperature per atom, which is 450 at 0°K was found to pass through a minimum of 390 at 28°K, and then continuously rise to a value of 705 at 300°K. A simple four parameter isotropic model was found to be insufficient to fit the observed lattice contribution, but some qualitative inferences may be made concerning the normal mode distribution. The smoothed curve heat capacity and thermodynamic functions are tabulated from 0–300°K. The following values were found for the thermodynamic functions at 298·15°K: $(H° - H_0^°)/T$ = 52·133J (g at. wt deg)$^{-1}$, $S°$ = 95·25 eu. (auth)

16031 A NUCLEAR MAGNETIC RESONANCE STUDY OF WATER IN CLAY. T. H. Wu (Michigan State Univ., East Lansing). J. Geophys. Res., 69: 1083-91(Mar. 15, 1964).

The bonding between clay minerals and water was studied experimentally by means of nuclear magnetic resonance. Water and deuterium oxide were adsorbed on kaolinite, grundite, and montmorillonite, and the spin-spin relaxation and the spin-lattice relaxation times were determined. The results were used to analyze several aspects of adsorbed water behavior such as exchange with D_2O, effect of heating, and effect of adsorbed ions. At temperatures below 0°C the evidence indicates that the water close to the clay has structure different from that of ice. The measured relaxation times were compared with the viscosity of adsorbed water obtained from permeability tests and with the amounts of unfrozen water determined by calorimetric measurements. (auth)

16032 ELECTROCHEMISTRY OF NIOBIUM IN FUSED HALIDES. J. Dartnell (Battersea Coll. of Tech., London), K. E. Johnson, and L. L. Shreir. J. Less-Common Metals, 6: 85-93(Feb. 1964).

Anodic dissolution of niobium in molten NaCl–KCl yielded sparingly soluble $NbCl_3$ at low current densities and blue solutions of Nb(IV) at high current densities, whereas only Nb(IV) solutions were produced from Nb and molten LiCl–KCl. Reduction of Nb(III) to metal occurred at ~–1.5 V vs Cl^-/Cl_2 but Nb(IV) solutions were reduced by a more complex process probably involving alkali metal as an intermediate. Some approximate values of E^0 for the niobium oxidation states and of ΔG_f^0 for the chloride solutions were evaluated. (auth)

16033 PHYSICAL CHEMISTRY OF IODINE AND REMOVAL OF IODINE FROM GAS STREAMS (REVIEW OF WORK IN AEROSOL GROUP, A.E.R.E., HARWELL). A. C. Chamberlain, A. E. J. Eggleton, W. J. Megaw, and J. B. Morris (Atomic Energy Research Establishment, Harwell, Berks, Eng.) J Nucl. Energy, Pt. A & B, 17: 519-50 (Dec. 1963)

The work of the Aerosol Group at Harwell on the removal of iodine from gas streams is reviewed. Work of other groups is mentioned only where it reflects directly on Harwell work. The main features of the work are: (a) Tests of the behaviour of iodine released into reactor containment vessels show that rapid sorption on the walls occurred, and that the iodine remaining airborne after periods of order an hour was in nonelemental form. (b) Laboratory and pilot plant studies show that the sorption of iodine on particulate matter and the formation of nonelemental gaseous compounds occurred with varying methods of release of iodine and in CO_2 as well as air. (c) Tests of iodine absorption in charcoal beds, and tests of the ignition temperature of some charcoals were made to enable the efficient removal systems to be specified. (d) Investigations of the physical chemistry of iodine at low gaseous concentrations enabled one of the nonelemental forms to be identified as methyl iodide. (auth)

16034 CATALYTIC EXCHANGE OF METHANE AND DEUTERIUM ON PLATINUM, RUTHENIUM, AND PLATINUM–RUTHENIUM ALLOYS. D. W. McKee and F. J. Norton (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem., 68: 481-9(Mar. 1964).

The exchange reaction between methane and deuterium was studied in the temperature range 70 to 200°C on unsupported platinum, ruthenium, and platinum–ruthenium alloy catalysts. Platinum-rich catalysts were found to be the most active and the order of initial appearance of the deuteriomethanes was $CH_3D > CH_2D_2 > CHD_3 > CD_4$. Ruthenium-rich alloys gave CD_4 as the most abundant initial product and the rates of formation of the different species were initially $CD_4 > CH_3D > CHD_3 > CH_2D_2$. In all cases, the rates of the exchange reaction were approximately first order in methane pressure and negative order in deuterium pressure. In addition, the concentration of chemisorbed hydrogen on the metal surface during the exchange reaction was followed by simultaneous measurements of the rate of formation of HD. The results indicate that the reaction takes place by different mechanisms with the two metals. With platinum, the dominant mechanism is stepwise exchange, whereas multiple exchange processes are more important in the case of ruthenium. (auth)

16035 ON THE CORRESPONDING STATES BEHAVIOR OF SODIUM, POTASSIUM, RUBIDIUM, AND CESIUM. J. F. Walling and A. W. Lemmon, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem., 68: 534-7(Mar. 1964).

Vapor pressure measurements on Na, Rb, Cs, and Hg were scaled to the vapor pressure curve for potassium. Predictions of the scale factors were made from parameters of the Rydberg potential function and triple-point constants. Results suggest that the alkali metals have the same reduced vapor pressure at any given reduced temperature, but this may not be the case for mercury. (auth)

16036 STUDY OF THE MÖSSBAUER EFFECT IN CRYSTALLINE AND VITREOUS $FeCl_3 \cdot 6H_2O$. H. Bernas

and M. Langevin (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. Phys. (Paris), 24: 1034-6(Nov. 1963). (In French)

The resonant absorption spectrum of crystalline $FeCl_3 \cdot 6H_2O$ shows two peaks whose isomeric shifts are not the ones expected for Fe^{+++} ions. The spectrum of the same substance in the vitreous state, however, shows only one peak, shifted by the amount expected for Fe^{+++} ions. The magnitude of the effect seems directly related to the viscosity of the absorbing medium. Possible applications to the study of structure of glass are indicated. (auth)

16037 URANIUM DIOXIDE OXIDATION WITH FORMING INTERMEDIATE PHASES. H. Scheibe and W. Ermischer (Zentralinstitut für Kernforschung, Bereich Werkstoffe und Festkörper, Rossendorf, Ger.). Kernenergie, 7: 95-102(Feb. 1964). (In German)

An experimental study was made of the UO_2 to U_3O_8 oxidation process. At low temperatures, depending on the activity of the powder, the oxidation of UO_2 yields a U_3O_7 shell around the UO_2 grain (160 to 220°C). Further oxidation is determined by the diffusion of oxygen through this shell and yields U_3O_{12} (280 to 290°C). Then follows U_3O_{13} (375 to 400°C) and finally U_3O_8 as more oxygen is absorbed. No further increase of the oxygen content occurs up to 800°C. The exothermal effects established through differential thermal analysis may be due to lattice transformation. (OTS)

16038 EXPERIENCES WITH THE THERMAL DECOMPOSITION OF URANYL NITRATE HYDRATE. Jozsef Lovasi. Kohasz. Lapok, 97: No. 1, 45-51(Jan. 1964).

Thermal decomposition of uranyl nitrate hydrate presents difficulties in a stationary system. By operating in a superheated water vapor stream at 400°C and using material previously heated to 180–196°C, it is possible to obtain UO_3 containing 0.2–0.4% NO_3. Another feasible method consists of heating the hydrate to 180°C at a rate of 5°C per hour, followed by denitration at 400°C in superheated water vapor stream. The UO_3 obtained by this method contains 0.42% NO_3. Derivatographic techniques were employed in the investigations. (OTS)

16039 METAL CHELATES OF RARE EARTHS. I. COMPOSITION, STABILITY, AND ANALYTICAL APPLICATIONS OF ALIZARIN RED S CHELATES OF SCANDIUM AND YTTRIUM. Kailash N. Munshi, Surendra N. Sinha, Satendra P. Sangal, and Arun K. Dey (Univ. of Allahabad, India). Microchem. J., 7: 473-84(1963).

The formation of pink colored chelates between scandium and Alizarin Red S (λ_{max} 500 mμ) and yttrium and Alizarin Red S (λ_{max} 510 mμ) at pH 4.0 are reported. Absorbance measurements indicate the composition of the chelates to be 1:2 (metal:chelating agent). Adherence to Beer's law is observed over a wide range of metal concentration; the color intensities are also stable within a wide range of pH. The values of log K (K = stability constant) were calculated by two different methods and are 9.0 and 9.4 for the scandium chelate, and 9.6 and 9.5 for the yttrium chelate (pH = 4.0; temperature = 25°C). The effects of pH, temperature, time, and diverse ions on the reactions were studied, and suggestions are made on the possible use of Alizarin Red S in the determination of scandium and yttrium. (auth)

16040 π-COMPLEXES IN CATALYTIC TRITIATION. J. L. Garnett and W. A. Sollich (Univ. of New South Wales, Sydney). Nature, 201: 902-3(Feb. 29, 1964).

It is shown how a recently proposed new π complex chemisorption theory for heterogeneous catalysis may be applied to predict molecular reactivity in catalytic tritiation using alkyl benzenes as a model series with deuterium as a tracer for tritium. The associative and dissociative π complex substitution mechanisms are discussed. Both mechanisms involve a π complex chemisorbed aromatic molecule horizontally oriented on the catalyst surface. From the alkyl benzene results and other data, the dissociative π complex substitution mechanism appears to predominate in platinum catalyzed exchange reactions with deuterium oxide. (P.C.H.)

16041 RELAXATION-TIME DETERMINATION IN QUADRUPOLAR RESONANCE. E. Grossetti, E. Tartaglione, and G. Brescia (Università, Naples). Nuovo Cimento (10), 31: 520-4(Feb. 1, 1964).

The transverse relaxation times T_2^* were determined for the pure paradichlorobenzene and for the latter in the presence of the extraneous molecules, whose resonance frequency for two of these is very close to that of the pure substance $\Delta\nu = -0.483$ MHz, $\Delta\nu = +0.567$ MHz, and a substance with a $\Delta\nu = +235.767$ MHz large, but positive, while others were using substances with $\Delta\nu$ large but negative, as a function of the percentage of extraneous substance in the pure paradichlorobenzene. Moreover the measurements allowed the calculation of the number N of molecules of the lattice, which do not enter into resonance because of the presence of only one perturbing center. The same number N was obtained determining the decrease of the intensity of the signal while increasing the percentage of the impurity molecular concentration. The obtained values are comparable with those obtained by others. (auth)

16042 ON H → D ISOTOPE EXCHANGE BETWEEN CHLOROPHYLL-TYPE PIGMENTS AND DEUTERIUM-CONTAINING COMPOUNDS. A. N. Sidorov. Opt. Spectry. (USSR) (English Transl.), 15: 454(Dec. 1963).

Nuclear magnetic resonance was used in an investigation of H → D exchange in chlorophyll molecules to determine the location of the exchangeable atoms. The dependence of the location of the exchangeable H atoms in the molecules of chlorophyll and its analogs on the character of the medium in which the exchange takes place was also studied. It was found that the spectral changes of chlorophyll, methyl chlorophyllide, and phenophytin on contact with CH_3OD, D_2O, or CH_3COOD are alike (disregarding changes brought about by exchange of the central H atoms of phenophytin). It was concluded that the location of the exchangeable H atoms in the molecules of the pigments is identical and does not depend, within the limits of the conditions of the experiments, on the basicity or acidity of the medium. (P.C.H.)

16043 EVIDENCE OF HYDROGEN BONDING WITH URANYL NITRATE HEXAHYDRATE IN THE LUMINESCENCE SPECTRUM OF Mg-PHTHALOCYANINE. G. I. Kobyshev, G. N. Lyalin, and A. N. Terenin. Opt. Spectry. (USSR) (English Transl.), 15: 456-7(Dec. 1963).

Fluorescence spectra of the Mg phthalocyanine (MgPhc) molecules adsorbed on silica gel and on aluminosilica gel of a higher spectral resolution was obtained with a photoelectric spectrophotometer equipped with a DFS-4 diffraction grating. The luminescence spectra of both adsorbents show the same dominant 702 mμ maximum. From measurements of the infrared absorption spectra it is known that H_2O molecules coordinated with the UO_2^{2+} cation easily enter into hydrogen bonds with organic molecules, even if the latter are basically weak. From this fact and comparison of the spectra, an explanation of the characteristic change in the uranyl-sensitized luminescence of MgPhc is given. (P.C.H.)

16044 THE NATURE OF DIFFUSIVE MOTIONS OF Fe^{57} IONS IN GLYCERINE AND THE MOSSBAUER EFFECT. K. S. Singwi and J. E. Robinson (Argonne National Lab., Ill.). Phys. Letters, 8: 248-9(Feb. 15, 1964).

A jump diffusion model was used to study the broadening of the Mössbauer resonance line by diffusive motion of Fe^{57} in glycerine. In this model, the Fe ions are surrounded by glycerine dipoles in a minimum energy configuration, and the net motion of the ions consists of a hopping within its shell and the diffusive motion of the shell itself. An estimate of the jump time and the line width was made. (L.B.S.)

16045 ELECTRONIC TRANSPORT IN STRONTIUM TITANATE. H. P. R. Frederikse, W. R. Thurber, and W. R. Hosler (National Bureau of Standards, Washington, D. C.). Phys. Rev., 134: A442-5(Apr. 20, 1964).

The conductivity and the Hall and Seebeck coefficients of reduced and doped strontium titanate were measured over the temperature range 4.2–300°K. An average effective mass of about 10 m_0 was deduced from these experiments. This value agrees well with the results of a recent energy-band calculation for $SrTiO_3$ based on a tight-binding approximation. Phonon-drag contributions to the Seebeck coefficient appear to be negligible above 50°K. Such a result is expected in view of the very small heat conductivity reported by Sievers. (auth)

16046 ON THE QUANTUM STATISTICAL THEORY OF RELAXATION IN ISOLATED SPIN SYSTEMS. J. A. Tjon (Rijksuniversiteit, Utrecht). Physica, 30: 1-16(1964).

The long time approach to statistical equilibrium of a spin system, isolated from the lattice vibrations, is studied, starting from the relaxation function of Kubo and Tomita. Only the behavior of the longitudinal magnetization is considered. The formalism used is based on the fact that in general a coarse grained description of the behavior of macroscopic variables is sufficient. For this purpose quantum-mechanical phase cells, which are characterized by the macro energy and the longitudinal magnetization, are introduced. It is derived that in terms of these phase cells the asymptotic behavior of the system is described by a first order differential equation, the so-called master equation. From this derivation the important condition follows that this master equation is only valid in the presence of either a large magnetic field or a strong exchange interaction between the spins. In investigating the relaxation function with the aid of the master equation use is also made of a linearity condition, which implies that the system is not far from statistical equilibrium. The result for the spin-spin relaxation time, computed in this way, disagrees with that of Caspers, but is the same as found by Hartmann and Anderson. Finally the theories on spin-spin relaxation are discussed. (auth)

16047 THE BASIC KINETIC EQUATIONS FOR PARA-ORTHO-HYDROGEN MIXTURES. L. Waldmann (Max-Planck-Institut für Chemie, Mainz). Physica, 30: 17-37 (Jan. 1964).

The collision of two equal molecules is considered from the quantum mechanical point of view, and the Ehrenfest-Oppenheimer theorem is enunciated in a general form. The matrix Boltzmann equation for a dilute gas consisting of molecules in degenerate states is established. The equality of collision partners is taken into account in the scattering amplitude. Hydrogen at low temperature is considered in detail. This is one of the most simple polyatomic gases. Only a few internal molecular states are involved. As there are practically no para-ortho-transitions, only elastic collisions occur. Hence, the internal states may be regarded as degenerate. Such a gas can exactly be described. By assuming isotropic orientation of the molecular axes, one obtains ordinary truncated Boltzmann equations for the para-ortho-mixture. In the case of spherical interaction these simplify again; the remaining two cross sections are now effectively identical with those postulated by Cohen et al. from physical reasons. Finally the bearing of the different approximations is discussed. (auth)

16048 MAGNETIC EXCHANGE INTERACTIONS IN $Nb_2Mn_4O_9$ AND $Nb_2Co_4O_9$. W. P. Osmond (Mullard Research Labs., Redhill, Surrey, Eng.). Proc. Phys. Soc. (London), 83: 85-92(Jan. 1964).

Possible indirect and direct magnetic exchange interactions are studied in the hexagonal compounds $Nb_2Mn_4O_9$ and $Nb_2Co_4O_9$, of which the modified corundum crystal structure and antiferromagnetic spin arrangement were previously established. In the manganese compound the relative strengths of the various interactions, as calculated by matrix methods, are consistent with estimates made from consideration of the various possible types of orbital overlap, and here an additional, super-superexchange interaction appears possible. In $Nb_2Co_4O_9$ the treatment indicates that most of the interactions must be considerably weaker by reason of the larger 3d electron population of the Co^{2+} ion, and this contention is supported by the much lower Néel temperature $\theta_N = 30°K$ compared with 125°K). In particular, the intra-lattice interaction should be very weak but still negative, in contrast to a positive value derived from susceptibility measurements. (auth)

16049 PRODUCTION OF URANIUM, THORIUM, PLUTONIUM, AND THEIR COMPOUNDS. Reactor Fuel Process., 7: No. 1, 71-82(Winter 1963-64).

Preparation of UO_2 by reduction of UO_3, development of other processes for UO_2 production, coating of UO_2 particles, preparation of uranium carbides, coating of uranium carbides, preparation of plutonium-containing uranium carbides, preparation of thorium–uranium carbides, preparation of uranium beryllides, properties of UN, preparation of U metal by bomb reduction of UF_4, and preparation of ThO_2 particles are discussed. (53 references) (M.C.G.)

16050 NEW NOBLE GAS COMPOUNDS. R. D. Peacock and J. H. Holloway (Univ. of Birmingham, Eng.). Sci. Progr. (London), 52: 42-9(Jan. 1964).

A review is presented on the synthesis of rare gas compounds, with special attention given to xenon compounds. The physical properties of xenon fluorides and oxides are given. Reactions of xenon fluorides are also shown. (P.C.H.)

16051 THE TRANSURANIUM ELEMENTS. K. W. Bagnall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Sci. Progr. (London), 52: 66-83(Jan. 1964).

The transuranium element place in the periodic classification is described as are their various valency states. Oxides and other compounds are listed. Radioactive hazards in working with the transuranium elements are discussed and methods of handling indicated. (P.C.H.)

16052 XENON TETROXIDE: PREPARATION AND SOME PROPERTIES. Henry Selig, Howard H. Claassen, Cedric L. Chernick, John G. Malm, and John L. Huston (Argonne National Lab., Ill.). Science, 143: 1322-3 (Mar. 20, 1964).

Xenon tetroxide is a yellow solid at low temperature. It has a vapor pressure of about 25 mm-Hg at 0°C and is un-

stable at room temperature. The infrared spectrum of the vapor shows it to have tetrahedral symmetry. (auth)

16053 XENIC ACID: REDUCTION AT THE DROPPING-MERCURY ELECTRODE. Bruno Jaselskis (Loyola Univ., Chicago). Science, 143: 1324(Mar. 20, 1964).

Xenic acid is reduced at the dropping-mercury electrode in a single step to xenon. The half-wave potential for the reduction of xenic acid changes from approximately −0.10 to −0.360 volt against a saturated Hg_2SO_4−Hg reference electrode in the pH range 4.60 to 8.00. The diffusion current varies linearly with concentration of xenic acid. (auth)

16054 SELF-DIFFUSION IN MIXTURES. PART 6. SELF-DIFFUSION OF HYDROGEN IN CERTAIN GASEOUS MIXTURES. L. Miller and P. C. Carman (National Chemical Research Lab., South African Council for Scientific and Industrial Research, Pretoria). Trans. Faraday Soc., 60: 33-7(Jan. 1964).

Tritium has been employed as an isotopic tracer to determine self-diffusion of hydrogen in admixture with CO_2, CF_2Cl_2, krypton, and xenon. Owing to the large difference in mass between HT and H_2, tracer diffusion of tritium is not directly related to self-diffusion of hydrogen, and a brief theoretical exposition of their relationship is given. (auth)

16055 ANALYSIS OF HYDROGEN-BONDED CRYSTALS BY NEUTRON DIFFRACTION TECHNIQUES. Jagdish Shankar and V. M. Padmanabhan (Atomic Energy Establishment, Trombay, India). p.269-77 of "Crystallography and Crystal Perfection." London, Academic Press, 1963.

Some of the recent work on hydrogen-bonded crystals by neutron diffraction studies is described. The results are analyzed to bring out some of the features of the bond type. (auth)

16056 CALCULATION OF THE EQUATION OF STATE OF HYDROGEN AND METHODS OF VERIFICATION. J.-P. Plantevin, P. Veyrie, and A. Gervat (Commissariat à l'Énergie Atomique, Paris). p.229-33 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The energy and pressure of hydrogen at thermodynamic equilibrium was calculated as a function of density and temperature. The law of mass action was applied to the low and average densities, the densities involved in calculation of partition functions. The Feynman-Metropolis-Teller method was used at high densities. The results were applied to calculation of the Rosseland mean and studies of shock waves in hydrogen. The equations of state and energy for hydrogen at thermodynamic equilibrium were calculated in the following region: $10^{-10} \leq p \leq 10^3$ g/cm^3 and $300 \leq T \leq 10^{8}$°K. (tr-auth)

16057 MOBILITIES OF MASS-IDENTIFIED IONS IN NITROGEN. D. W. Martin, W. S. Barnes, G. E. Keller, D. S. Harmer, and E. W. McDaniel (Georgia Inst. of Tech., Atlanta). p.295-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The drift velocities of ions in nitrogen, which were identified by a mass spectrometer at the end of their transit, were measured. Spectra of the drift times over distances up to 21 cm were obtained for the ions N^+, N_2^+, N_3^+, and N_4^+, for gas pressures from 0.04 to 0.22 torr, and for applied field strengths of from 1 to 4 volts/cm. The drift velocities of all four species were found to be linear in E/p_0 for values of E/p_0 less than about 20 volts/cm-torr. The low-field reduced mobilities obtained for these ions were 3.3, 1.8, 3.1, and 2.4 cm^2/volt-sec respectively. (auth)

16058 DRIFT VELOCITIES OF ATOMIC AND MOLECULAR IONS IN NITROGEN. K. B. McAfee and D. Edelson (Bell Telephone Labs., Inc., Murray Hill, N. J.). p.299-304 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

An ion drift apparatus using a mass analyzer to detect ions at the cathode was constructed and employed to obtain simultaneous measurement of drift velocity and mass. In nitrogen four ions were produced and their relative intensities determined while a complete theory was used to evaluate the ionic velocities from experiment. Two rapid reversible collision processes were deduced as follows: $N^+ + N_2 = N_3^+$ and $N_2^+ + N_2 = N_4^+$. The latter reaction, earlier proposed by Varney, was confirmed by measurements of ionic velocity and intensity. At very low E/p the mobility of N_4^+ corresponded closely with a mobility determined by Mitchell. (auth)

16059 IDENTIFICATION OF IONS IN DILUTED GASES WITH THE HELP OF A SYMMETRICAL HIGH FREQUENCY OSCILLATOR. H. Eiber (Technische Hochschule, Munich). p.305-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In German)

A method for measurement of ion mass at gas pressures up to a few mm Hg by means of an extremely fine grid of parallel wires, alternately connected to both terminals of a symmetrical HF-oscillator is described. The part of the ion current passing through the grid and reaching a collector plate is a function of HF-voltage and ion mass. First measurements in oxygen showed one positive ion, O_2^+ and two negative ions, O^- and O_3^-. At very low E/p only one negative ion, O_3^-, was present. In order to increase the resolution a device was built, combining this method with a mobility-measuring system of high selectivity. (auth)

16060 DRIFT VELOCITY OF IONS IN NITROGEN. R. N. Varney and J. A. Dahlquist (Washington Univ., St. Louis). p.309-10 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Ion mobility measurements were made in nitrogen using a single ion shutter of the Mitchell and Ridler type but operated with a square-wave pulse of short duration. The ions emerging through the shutter were observed by means of a fast oscilloscope. Throughout all the readings, two ionic speeds were noted, presumably attributable to two different types of ions. (M.C.G.)

16061 THE DRIFT VELOCITY OF IONS IN MERCURY VAPOR. F. R. Kovar and R. N. Varney (Washington Univ., St. Louis). p.311 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The drift velocity and mobility of mercury ions in mercury vapor were studied. Two different ionic mobilities were identified as due to Ag^+ and Hg_2^+. (M.C.G.)

16062 SOME PROPERTIES OF SLIGHTLY IONIZED GASEOUS MIXTURES. E. P. Zimin and V. A. Popov (Kryanovskii Inst. of Energy, Moscow). p.369-72 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The effects of Coulomb interaction of electrons and ions on the optimal composition of a gaseous mixture are discussed. The effects of a magnetic field are also considered. (M.C.G.)

16063 PREPARATION OF THORIUM OXALATE. (to Dow Chemical Co.). British Patent 952,499. Mar. 18, 1964. Priority date Aug. 15, 1960, United States.

A method of preparing thorium oxalate so that it exhibits a high-packed bulk density is described. It was found that on providing a constant ratio of a monovalent inorganic cation to the thorium during precipitation of thorium oxalate from an aqueous solution of a thorium salt reacting with oxalic acid at 40°C or above. The sodium, potassium, ammonium, or lithium cation, or mixtures of them, are added in an amount directly proportional to that of the thorium within the range of 0.5 to 15 moles of cation per mole of thorium. The pH of the aqueous thorium salt solution is kept below 4. (M.C.G.)

16064 IMPROVEMENTS IN OR RELATING TO PROCESSES FOR OBTAINING URANIUM OXIDE. (to Philips' Gloeilampenfabrieken). British Patent 952,856. Mar. 18, 1964. Priority date June 30, 1959, Netherlands.

A process for obtaining sinterable uranium oxide is described, in which uranium dioxide is prepared by reduction at approximately 700 to 1000°C of higher oxides of uranium or materials generating such higher oxides when heated. Immediately after the reduction, the uranium dioxide is oxidized at about 700 to 1000°C in an atmosphere containing water vapor, but otherwise free of elemental or combined oxygen. The result of this process is product that is not pyrophoric and has a composition between $UO_{2.02}$ and $UO_{2.085}$, which is a deviation from stoichiometry desirable for proper sinterability. (M.C.G.)

16065 PROCESS FOR THE DIRECT PREPARATION OF PRACTICALLY SPHERICAL; GRANULAR, AMMONIUM URANYL SULFATE OF UNIFORM PARTICLE SIZE. Marie E. A. Hermans and Theo van der Plas (to Stichting Reactor Centrum Nederland). U. S. Patent 3,126,250. Mar. 24, 1964. Priority date Sept. 18, 1959, Netherlands.

A process is given for the direct preparation of a uraniferous material having a very narrow maximum in its particle size distribution. This material is suitable for the preparation, by ammonia conversion and hydrogen reduction, of granular UO_2 of uniform size for use in fuel suspensions or slurries in homogeneous reactors. The process comprises adding NH_3 to a solution of a uranyl salt up to the point of incipient precipitation, dissolving a relatively large amount of $(NH_4)_2SO_4$ in the solution, stirring the solution to begin precipitation, maintaining the pH at a critical value between 2 and 3 during the precipitation, and separating the precipitate of a complex ammonium uranyl sulfate. The actual critical pH value depends on the initial uranyl salt concentration. Preferably, NH_4NO_3 is added to the solution before NH_3 is added. Two examples of the process are given in which the precipitates were converted to UO_2 with respective particle sizes of 7 and 4 microns. (D.L.C.)

Organic Chemistry

16066 (NP-13736) CONTRIBUTION A L'ÉTUDE DE LA LIAISON HYDROGÈNE. ÉTUDE DE L'EFFET ISOTOPIQUE (theses). (Contribution to the Study of Hydrogen Bonds. Study of the Isotope Effect (thesis)). Robert Cardinaud (Paris. Université). 1959. 32p.

The preparation and analysis of deuteriated phenol, nitrophenols, and methanols were investigated. The isotopic effects on the demixing and vapor pressure of associated solutions were determined on deuteriophenol–heavy water and deuteriomethanol–cyclohexane systems. Twelve solutions, chosen to show the intensity and nature of the isotopic effect, were subjected to spectroscopic studies. The results of the thermodynamic and spectroscopic investigations showed how the isotopic effect seemed to indicate a difference in behavior of various alcohols and phenols with respect to the electron structure of the hydroxyl support. (J.S.R.)

16067 (TID-7689(p.128-33)) ACID CIRCULATION, VOLUME, REPLACEMENT, AND ENTRAINMENT MEASURED IN AN ALKYLATION PLANT WITH RADIOTRACER. D. E. Hull, B. A. Fries, and J. T. Gilmore (California Research Corp., Richmond).

A series of radiotracer tests was made on the sulfuric acid system in an alkylation plant in order to measure the separate circulation rates through all four pumps, to measure the volume of acid circulating in each reactor, to measure the rate at which spent acid is discharged and replaced by fresh acid in the reaction vessel, and to measure entrainment of acid by the alkylate as it goes from the first vessel over to the second. The movement of the acid was traced by making quick injections of ^{198}Au. (M.C.G.)

16068 EFFECT OF METAL IONS ON NUCLEAR HYPERFINE COUPLING CONSTANTS IN EPR SPECTRA. Toyokichi Kitagawa, Thomas Layloff, and Ralph N. Adams (Univ. of Kansas, Lawrence). Anal. Chem., 36: 925-6 (Apr. 1964).

Investigations were made on the effects of metal ions on the nuclear hyperfine coupling constants of the electron paramagnetic resonance (EPR) spectra of a variety of anions of aromatic nitro compounds. The effect of the metal ion on the N^{14} coupling constant (a_N) in chloronitrobenzene was investigated. The results show that shifts in a_N caused by metal ions are considerably greater than those occasioned by interaction with water or other hydrogen-bonding solvents. (P.C.H.)

16069 SYNTHETIC INCORPORATION OF C^{14} INTO TROPINE, (±) TROPIC ACID, AND ATROPINE. Gottfried Werner, Hans-Ludwig Schmidt, and Ewald Kassner (Max-Planck-Institut für Hirnforschung, Marburg a.d. Lahn, Ger.). Ann. Chem., 644: 109-16(1961). (In German)

Tropinone-N-$C^{14}H_3$ was produced in 70% yield by the condensation method of Robinson from $C^{14}H_3NH_2 \cdot HCl$, which was prepared from 1 mmole $NaC^{14}N$ (5 mC/mmole) by catalytic reduction. This was converted, without dilution of specific activity, into atropine-N-$C^{14}H_3$ sulfate monohydrate (10 mC/mmole) in 68% yield by way of tropine-C^{14} and o-acetylatropine-C^{14}. Racemic (±)tropic acid-1-C^{14} was obtained in 47.5% yield by treatment of benzyl Mg chloride (5 mmole) with $C^{14}O_2$, followed by Grignard reaction with isopropyl Mg chloride and decomposition with formaldehyde. This was transformed by tropine into the acetyl ester acid chloride of atropine, C^{14}-labeled in the ester carbonyl group. The total and radioactive yield of the sulfate monohydrate was 26%, with a specific activity of 0.42 mC/mmole. (BBB)

16070 CHEMICAL SYNTHESIS OF TRITIUM-LABELED LINOLEIC ACID. Demetrios S. Sgoutas and Fred A. Kummerow. (Univ. of Illinois, Urbana). Biochemistry, 3: 406-11(Mar. 1964).

Tritium-labeled linoleic acid with a specific activity of 357 mC/mmole was obtained in 70% yield from totally synthesized octadeca-9,12-diynoic acid. A source of 1 curie of tritium gas was used to semihydrogenate the diacetylenic acid in the presence of Lindlar's catalyst. Chemical and radiochemical purity of the final product were assessed by chromatographic methods. Evidence from mild oxidation indicated that the tritium-labeled linoleic acid was prepared with a specificity of greater than 95% of the activity at the 9, 10, 12, and 13 positions. (auth)

16071 ISOTOPE EFFECTS IN METHYL RADICAL ABSTRACTION REACTIONS. Mark Salomon (Univ. of Ottawa). Can. J. Chem., 42: 610-13(Mar. 1964).

The high k_H/k_D ratio found experimentally for methyl radical abstraction reactions is explained on the basis of classical rate theory. It is shown that if the bending frequencies in the activated complex approach zero, good agreement is found between experimental and calculated k_H/k_D values. For abstraction of H and D from hydrocarbons, both the tunneling and classical rate theories predict acceptable k_H/k_D values. Abstraction of H and D from H_2 and D_2, however, can best be explained on the basis of a classical process. (auth)

16072 ETARD REACTION. IV. DEUTERIUM ISOTOPE EFFECT. Owen H. Wheeler (Puerto Rico Nuclear Center, Mayaguez). Can. J. Chem., 42: 706-7(Mar. 1964).

Results on the oxidation of a mixture of toluene and α,α,α-trideuterotoluene with chromyl chloride in carbon disulfide at room temperature, under which conditions the minimum amount of chlorination occurs, are reported. The value of k_H/k_D indicates that the breaking of a C–H bond of the methyl group in toluene is the rate-determining step. (P.C.H.)

16073 THE QUANTITATIVE CHANGE OF TRITIATED WATER IN HYDROCARBON. A. Moghissi and K. Hogrebe (Kernforschungszentrums, Karlsruhe, Ger.). Intern. J. Appl. Radiation Isotopes, 15: 165-7(Mar. 1964). (In German)

Transformation of water in the preparation of hydrocarbons from Grignard reagents was studied. The reaction $RMgX + H_2O \rightarrow MgXOH + RH$ was used in the isotope effect studies employing tritium. Reactivity of inserted amount of tritiated water and activity in the product were compared. (M.C.G.)

16074 SYNTHESIS OF RING-LABELED L-THYROXINE-C^{14}. Melvin J. Gortatowski, Lindy F. Kumagai, and Charles D. West (Univ. of Utah, Salt Lake City). J. Med. Chem., 6: 800-2(Nov. 1963).

Although I^{131}-labeled and carboxyl C^{14}-labeled thyroxine have been used to study the metabolism of thyroid hormone, these labels are readily removed physiologically, and knowledge about the metabolic fate of the diphenyl ether moiety of the molecule is incomplete. Preliminary investigation of this aspect of thyroxine metabolism, L-thyroxine labeled with C^{14} in the phenolic ring was synthesized. To utilize a previous method for the convenient preparation of L-thyroxine from p-methoxyphenol, it was necessary to prepare this intermediate from phenol-C^{14} by the reaction scheme which is shown. Then, by modification of the Chalmers method for the condensation of N-acetyl-3,5-dinitro-L-tyrosine ethyl ester with p-methoxyphenol and conversion of the condensation product to L-thyroxine, it was possible to prepare L-thyroxine-C^{14} in 12 steps in an over-all yield of 2.6%. The detailed procedure is described. The starting material, uniformly labeled C^{14}-phenol (specific activity 1.3 mC/mmole, 2.3 mmoles or 216 mg) was converted to phenyl-C^{14}-benzenesulfonate by addition of benzenesulfonyl chloride in pyridine. The product was converted to the p-nitrophenyl derivative (with KNO_3 and concentrated H_2SO_4) which was converted by alkali to p-nitrophenol-C^{14}. This was treated with diazomethane to form p-nitroanisole-C^{14} which was reduced with Pt and H_2 to p-aminoanisole-C^{14}. By diazotization p-methoxyphenol-C^{14} was prepared, which was converted to L-thyroxine-C^{14} by the Chalmers procedure. Characterization of the labeled hormone by paper chromatography and assay of its endocrine potency are described. The L-thyroxine-C^{14} exhibited biological activity equivalent to authentic L-thyroxine when tested by the inhibition of propylthiouracil-induced goiters in rats and the suppression of thyroidal I^{131} uptake. (BBB)

16075 SYNTHESIS OF METHANE FROM WATER FOR TRITIUM MEASUREMENT. J. S. Anand and D. Lal (Tata Inst. of Fundamental Research, Bombay). Nature, 201: 775-7(Feb. 22, 1964).

A methane synthesis method developed for the counting of radiocarbon activity with the view of using it for tritium-counting was examined. In this method, methane is synthesized from CO_2 and hydrogen in the presence of ruthenium on aluminum oxide catalyst. However, half the original amount of hydrogen in this reaction is returned and large amounts of hydrogen have to be produced. To overcome these difficulties, attempts were made to make a continuous reaction in a closed system in which the two reactions, conversion to hydrogen by oxidation of zinc and the original reaction, would proceed simultaneously leading to a quantitative conversion to methane. This approach was successful and is described. The reaction was found to be quantitatively complete according to the effective reaction: $4Zn + CO_2 + 2H_2O \rightarrow CH_4 + 4ZnO$. (P.C.H.)

Radiation Chemistry and Radiochemistry

16076 (ANL-6812) LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART V. THE RADIATION CHEMISTRY OF PLUTONIUM HEXAFLUORIDE. Martin J. Steindler, David V. Steidl, and Jack Fischer (Argonne National Lab., Ill.). Dec. 1963. Contract W-31-109-eng-38. 24p.

Plutonium hexafluoride exposed to fission product gamma radiation decomposes to form plutonium tetrafluoride and elemental fluorine with a G value of 7.5 ± 1.7. Addition of one atmosphere of helium to plutonium hexafluoride at a pressure of ~80 mm Hg does not significantly change the G value for the decomposition compared with that for pure plutonium hexafluoride. Addition of 2 atmos of helium to plutonium hexafluoride at ~80 mm Hg results in a G value for the decomposition of 5.8 ± 0.9. A study of the effect of krypton on the decomposition of plutonium hexafluoride by gamma radiation revealed a marked enhancement of the decomposition at an electron fraction of krypton of 0.73 and an exposure dose of 1×10^8 rads. No such enhancement was observed at an exposure dose of 2×10^8 rads. Addition of fluorine or oxygen to plutonium hexafluoride resulted in a G value for the decomposition that was less than that obtained from the irradiation of pure plutonium hexafluoride. Irradiation of mixtures of plutonium tetrafluoride and elemental fluorine produced plutonium hexafluoride in concentrations greater than that calculated from the thermodynamic equilibrium constant at the temperature of the irradiations. (auth)

16077 (NP-13734) SUR L'APPLICATION DES RÉACTIONS DE POLYMÉRISATION A QUELQUES PROBLÉMES DE CHIMIE DES RAYONNEMENTS (theses). (The Application of Polymerization Reactions to Some Problems of Radiation Chemistry (thesis)). Annette Bernas nee Prevot (Paris. Université). [nd]. 95p.

The use of radiopolymerization to study the number and nature of free radicals formed, the mechanism of their formation, and their spatial distribution was investigated. The known data on radiation chemistry and polymerization reactions were first briefly reviewed. The techniques and experimental apparatus used and the characteristics and dosimetry of the x and γ radiation sources employed were

described. The radiopolymerization of some common vinyl monomers was investigated. These chain radical reactions are very sensitive, and it was proposed that they be used for the dosimetry of x and γ rays. As the majority of common monomers are insoluble in water, they can not be used for the study of the radiolysis of water. Acrylonitrile, soluble in water, was then analyzed in more detail. Its polymer is insoluble in the monomer and its aqueous solutions. Because of the polymerization of pure acrylonitrile or in aqueous solution, it was possible to envisage the following applications to radiation chemistry: the study of the spatial distribution of initiator centers for polymerization and the estimation of the number of free radicals formed per 100 ev of energy absorbed in water and acrylonitrile. These applications were investigated in some detail. (J.S.R.)

16078 (TID-7689(p.46-50)) SYNTHESIS, STORAGE AND MANIPULATION OF TRITIATED STEROID ESTROGENS OF HIGH SPECIFIC ACTIVITY. H. I. Jacobson, N. N. Saha, H. G. Neumann, V. Colucci, and E. V. Jensen (Chicago. Univ.).

Labeled steroid estrogens incorporating essentially carrier-free tritium were prepared. When an appropriate unsaturated precursor was available, catalytic "hydrogenation" with tritium gas was the method chosen for incorporation of the radioisotope. The radiochemical stability of the labeled hormones was determined. High dilution appeared to be a critical factor in minimizing decomposition on storage of such highly tritiated compounds. (M.C.G.)

16079 (CEA-tr-A-1411) PROCÉDÉ RADIOCHIMIQUE DE TRANSFORMATION D'HYDROCARBURES. (Radiochemical Process for Transformation of Hydrocarbons). Elroy Merle Gladrow. Translated into French from German Patent 1,086,680. June 28, 1956. 17p.

The transformation of hydrocarbons by irradiation with gamma rays and/or neutrons in the presence of activated charcoal is described. The gamma flux in the reaction zone is higher than 10^5 r/hr. In joint irradiation with gamma rays and neutrons, the gamma flux is more than 10^5 r/hr and the neutron flux is more than 10^{10} neutrons/cm^2/sec. Petroleum fractions can be used as the hydrocarbon, and the properties of the activated charcoal used as catalyst are given. The charcoal is impregnated with B^{10} or Li^6. (J.S.R.)

16080 QUANTITATIVE DETERMINATION OF THE FREE RADICALS FORMED IN THE RADIOLYSIS OF WATER, WITH THE AID OF A STABLE FREE RADICAL. G. V. Putirskaya and I. Matus (Central Research Inst. of Chemistry, Hungarian Academy of Sciences, Budapest). Acta Chim. Acad. Sci. Hung., 38: 249-59(1963). (In Russian)

The direct quantitative determination of the radicals formed by the radiolysis of water is described. The stable free radical α,α-diphenyl-β-picrylhydrazyl-p,p'-disulfonic acid disodium salt (SDPPH) was used as a scavenger. Measurements of the disappearance of SDPPH were made spectrophotometrically at 5200 Å at 25 ± 0.1°C in the presence and absence of air; air was found to have no effect on the rate of disappearance. The dependence of the rate of decomposition was measured as a function of concentration and corrections were made for this effect in remaining experiments. A 2.6×10^{-4} M solution of SDPPH exposed to x rays (14,000 rad/hr) is completely decomposed in 125 to 130 min; dependence of rate on initial concentration at different x-ray dose rates is plotted. $G_{(-SDPPH)}$ is found to be −9.88 molecules/100 ev, the mean of 5 determinations made from 6,500 to 38,200 rad/hr; from this $G_{(-H_2O)}$ equals −4.94 molecules/100 ev. The reaction constant for SDPPH with free radicals was found to be 9.7×10^3 l/mol sec. Near the critical concentration of SDPPH, its rate of destruction is proportional to the dose rate and is not a function of initial concentration. (BBB)

16081 RADIOPROTECTION OF LAZAREW'S REACTION. C. Piffault and J. Duhamel. Bull. Acad. Natl. Med. (Paris), 127: 305-9(Mar. 26, 1963). (In French)

The reversible loss of color of methylene blue in glycerol on irradiation with ultraviolet light suggests a possible protective mechanism against the effect of photons. Radiation from γ rays to the infrared ($\lambda > 3\mu$) is effective, glycerol may be replaced by other alcohols, and the dye may be replaced by other oxidation-reduction indicators with identifiable leuco forms. In water, destruction of methylene blue is slow and complete; no intermediates were detected spectrally. In glycerol, the reaction is complete and rapid and the color is restored spontaneously in the presence of O_2; the cycle may be repeated. The leuco form was identified in the decolorized solution. In mixtures of water and glycerol, reversibility extends to 80% water. Glycerophosphates were studied as solvents. In 12% solutions, irradiation in the infrared gives Lauth's violet; further irradiation destroys the color irreversible. If the Lauth's violet solution stands in darkness overnight, then irradiation gives reversible formation of leuco-violet. Solutions more concentrated in glycerophosphates or irradiation in the ultraviolet gave the usual Lazarew reaction without intermediates. A minimum power threshold for decoloration was found as a function of λ. Evolution stages in the presence of glycerophosphates are diagrammed; these are the same whether infrared or ultraviolet irradiation is used. The energy for leuco-blue formation and that for destruction were 15×10^{-16} and 2×10^{-15} cal/molecule for the ultraviolet and 10^{-14} and 34×10^{-13} for the infrared, respectively. Glycerol is thought to form a radioprotective complex with the dye. (BBB)

16082 RADIATION CHEMISTRY OF CYCLOHEXANE. VI. DILUTE SOLUTIONS OF CARBON TETRACHLORIDE AND CHLOROFORM IN CYCLOHEXANE. J. A. Stone and P. J. Dyne (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 42: 669-81(Mar. 1964).

A study of the effect of the addition of small amounts (<3.5%) of the halogenated compounds CCl_4, $CHCl_3$, and $CDCl_3$ on the radiolysis of cyclohexane showed that processes other than radical scavenging occur. At the lowest concentrations of solute that it was practical to employ (0.004 M) cyclohexyl radicals were scavenged without a corresponding reduction in the hydrogen yield. At higher solute concentrations $G(H_2)$ was reduced by a physical process that did not involve the scavenging of thermal hydrogen atoms but did lead to chemical reaction involving the solute. (auth)

16083 THERMOLUMINISCENCE AND EXOELECTRON EMISSION OF KCl PHOSPHORS, ACTIVATED BY MERCURY-LIKE IONS. H. Kaeaembre and A. Bohun (Inst. of Solid State Physics, Czechoslovak Academy of Sciences, Prague). Czech. J. Phys., 14: 54-62(1964).

An experimental investigation is made of thermostimulated electronic emission and luminescence in potassium halide crystals activated with "mercury-like ions." These phosphors were excited with x rays or ultraviolet light in the activator absorption bands. The transfer of activator excitation to the host lattice, the creation of color centers by these processes, and the mechanism of exoelectron emission are discussed. (auth)

16084 THERMAL AND RADIATION STABILITY OF THE ARGON CLATHRATE OF HYDROQUINONE. J. W. McClain and W. S. Diethorn (Pennsylvania State Univ., University Park). Intern. J. Appl. Radiation Isotopes, 15: 151-7(Mar. 1964).

Argon release from the dilute clathrate, containing 1.7 wt % argon, was studied at temperatures up to 100°C and at room temperature after irradiation. Above room temperature, release is rapid, confirming the low thermal stability of the clathrate. Radiation increases clathrate stability. After a dose of 1×10^7 rad, no argon release was observed during 25 days at room temperature. (auth)

16085 THE SPECIFIC CHEMICAL SYNTHESIS OF γ-P^{32} LABELED ADENOSINE 5'-TRIPHOSPHATE. D. L. M. Verheyden, W. E. Wehrli, and J. G. Moffatt (Syntex Inst. for Molecular Biology, Palo Alto, Calif.). J. Am. Chem. Soc., 86: 1253-4(Mar. 20, 1964).

An entire specific chemical synthesis of ATP-γ-^{32}P that may be extended to any nucleoside 5'-triphosphate and to δ-^{32}P nucleoside 5'-tetraphosphates is described. (P.C.H.)

16086 THE TRANSITION STATE IN METHYL RADICAL FORMATION, THE α-DEUTERIUM EFFECT. Andreas A. Zavitsas and Stanley Seltzer (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc., 86: 1265-7(Mar. 20, 1964).

The α-deuterium isotope effect in the formation of methyl radicals by carbon-carbon rather than carbon-mercury bond cleavage was determined. The compound used was methyltrideuteriomethylphenylcarbinyl hypochlorite. The hypochlorite was irradiated by an incandescent lamp as a 0.5M solution in CCl_4 in the presence of cyclohexane (1.0M); under these conditions the decomposition is a long chain reaction and complicating side reactions amount to less than 0.5% by gas-liquid chromatography. The isotope effect was determined at temperatures between −9 and 75°C. The results indicate that well over half the vibrational changes accompanying the formation of the methyl radical occur in the transition state. It was concluded that the transition state is more akin to products than to reactants in the reaction involving C−C bond cleavage. (P.C.H.)

16087 ESR STUDY OF NO_2 AND NO_3 IN IRRADIATED LEAD NITRATE. R. M. Golding and Michael Henchman (University Chemical Lab., Cambridge, Eng.). J. Chem. Phys., 40: 1554-63(Mar. 15, 1964).

Lead nitrate crystals were irradiated with electrons at room temperature and their electron spin resonance spectra examined at 77°K to reveal three paramagnetic species. One species shows no hyperfine structure and has an isotropic g tensor with a g value at the free spin value: little can be said of its nature. The others are located, by their spectral anisotropy, at nitrate sites in the crystal with the axes of their axially symmetric g tensors parallel to the nitrate triad axes. One of these species is interpreted as NO_3: it shows no nitrogen hyperfine structure but a slight interaction with ^{207}Pb. The other is identified as NO_2 rotating in the plane of the nitrate site. Theoretical predictions are in accord with these assignments. Various conclusions are drawn for the radiation chemistry. Other species than the NO_2^- and O_2, revealed by chemical analysis, are significant products. The particular lattice determines the nature of these products, their stability and, in the case of NO_2, its mechanism of formation. The annealing kinetics of NO_2 and NO_3 differ from that of the NO_2^-: Mechanisms previously postulated for the latter are almost certainly too simple. (auth)

16088 IONIZATION OF U, UO, AND UO_2 BY ELECTRON IMPACT. Joseph B. Mann (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys., 40: 1632-7(Mar. 15, 1964). (LADC-6045)

The first ionization potential of uranium and the first appearance potentials of UO and UO_2 by electron impact were measured in a mass spectrometer, using the retarding potential difference (RPD) method. Small modifications of the RPD source are described. Crucibles of zirconium diboride were found to be preferable to tantalum crucibles for vaporization of uranium metal. Correction is made to the uranium appearance potential for thermally excited low-lying levels of the uranium atom, and for the several possible ionization paths. The ionization potential for uranium is 6.11 ± 0.05 ev; for UO and UO_2 the appearance potentials are 5.72 ± 0.06 ev and 5.5 ± 0.1 ev. Ionization probability curves were determined for U and UO. (auth)

16089 NONEXPONENTIAL DECAY OF LUMINESCENCE OF RARE-EARTH CHELATES. Carl W. Kuhlman and S. I. Weissman (Washington Univ., St. Louis). J. Chem. Phys., 40: 1776-7(Mar. 15, 1964).

Studies were made on the nonexponential decay of luminescence of europium complexes of picrate, dibenzoylmethide (DB), and thenoyltrifluoracetonate (TTA) and the DB and TTA compounds of terbium. Solutions in methylcyclohexane, ethanol, and toluene were studied in the temperature range 77−300°K. The terbium compounds and the europium picrate yielded simple exponential decays under all conditions, with decay constants of the order 500×10^{-6} sec in rigid glasses and 30×10^{-6} sec in fluids at room temperature. The decays of the luminescences of the DB and TTA compounds of europium were not exponential at low temperatures in rigid media. (P.C.H.)

16090 ELECTRON SPIN RESONANCE OF IRRADIATED SINGLE CRYSTALS OF ϵ-CAPROLACTAM. Michio Kashiwagi and Yukio Kurita (Toyo Rayon Co., Kamakura, Japan). J. Chem. Phys., 40: 1780-2(Mar. 15, 1964).

ESR analyses of irradiated single crystals of ϵ-caprolactam and well-resolved hyperfine couplings of N and H nuclei are reported. The spectrum has 24-line structure with ^{1}H hyperfine couplings $A(H_{II\alpha})$, $A(H_I)$, $A(H_N)$, and ^{14}N coupling A(N). The principal values of the hyperfine couplings and g factor are tabulated. Examination of the ESR spectra of the irradiated deuterated crystals confirmed that $A(H_N)$ is due to β-proton attached to the amide nitrogen atom. (P.C.H.)

16091 ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE IN SOME ALIPHATIC ACIDS AND SALTS. Yu. D. Tsvetkov, K. R. Rowlands, and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). J. Chem. Soc.: 810-20(Feb. 1964).

Radicals trapped in solid aliphatic dibasic acids and a few monobasic acid salts subjected to high-energy x or γ rays were identified by electron spin resonance. The hyperfine coupling constants were measured and are discussed. Some comments are made on radical stability. (auth)

16092 THE EFFECT OF ULTRAVIOLET IRRADIATION ON CHLORPROMAZINE. I. AEROBIC CONDITION. C. L. Huang and F. L. Sands (Spring Grove State Hospital, Baltimore). J. Chromatog., 13: 246-9(Jan. 1964).

A photo-oxidation study was made on chlorpromazine. An aqueous solution of chlorpromazine·HCl was placed in a porcelain evaporating dish and irradiated with uv light for a period of 24, 48, and 72 hr. After the irradiation, changes in the color as well as pH (from 5.9 to 1.72)

of the solution were noted. The physical properties of 12 compounds isolated from the mixture of uv irradiated solution of chlorpromazine·HCl are given. (P.C.H.)

16093 RADIATION CHEMISTRY OF POLYETHYLENE. VI. RADIOLYSIS IN THE PRESENCE OF NITRIC AND NITROUS OXIDES. B. J. Lyons and Malcolm Dole (Northwestern Univ., Evanston, Ill.). J. Phys. Chem., 68: 526-34 (Mar. 1964).

The radiation of polyethylene and polypropylene in the presence of nitric and nitrous oxides showed that the consumption of NO was independent of pressure, that the hydrogen evolution was unaffected by the presence of NO, that the ratio of NO consumed to N_2 produced was about 3.4, that some water was produced, that N_2O reacted at about one-tenth the rate of NO, that the reaction of NO with isotactic polypropylene during the irradiation probably followed the same mechanism as in the case of polyethylene, but with somewhat lower yields, and that the yield of free radicals, G(R·), was the same order as found by esr measurements. There was no evidence of the existence of a chain reaction. A mechanism is suggested for the enhancement of cross linking by nitrous oxide. (auth)

16094 THE RADIATION-INDUCED CHLORINATION OF TOLUENE BY STANNIC CHLORIDE. Frank B. Galimba, Willard E. Wilson, and Aryeh H. Samuel (Stanford Research Inst., Menlo Park, Calif.). J. Phys. Chem., 68: 647-51(Mar. 1964).

Results of the radioinduced chlorination of toluene by stannic chloride are presented. It appears that combined m- and p-chlorotoluene yields are about 30% higher than the o-chlorotoluene yield, and that yields approach an asymptotic level. This level appears to be near $G(C_7H_7Cl) = 0.2$. There appears to be no dependence of chlorotoluene yields on dose, temperature, or ethylene concentration. However, there may be a direct dependence of yield on dose rate. (P.C.H.)

16095 MECHANISM OF RADIOLYTIC OXIDATION OF FERROUS ION. D. Katakis and A. O. Allen (Brooklyn National Lab., Upton, N. Y.). J. Phys. Chem., 68: 657-60 (Mar. 1964). (BNL-7529)

Studies were made on the effect of very low concentrations of oxygen on the yield of ferrous sulfate oxidation by gamma rays in H_2SO_4 at concentrations ranging from 0.2 to 2.2 M. Results are also presented on the effect of low concentrations of copper ion on the ferrous oxidation yield. Mechanisms for the reactions are proposed, and yields are tabulated. (P.C.H.)

16096 A RADIATION-INDUCED SOLID STATE CRYSTALLIZATION PROCESS. Ted B. Flanagan and Mark K. Goldstein (Univ. of Vermont, Burlington). J. Phys. Chem., 68: 663-4(Mar. 1964).

The rehydration of manganous oxalate, the dihydrate of which had been subjected to various exposures of reactor irradiation ($\sim 1.0 \times 10^{13}$ n cm^{-2} sec^{-1}, total neutron flux) and then dehydrated in vacuo, was investigated. The trend in the rehydration behavior strongly suggests that reactor irradiation aids in the crystallization of the anhydride during the dehydration process. The sample irradiated for the longest time (9.8×10^{18} n cm^{-2} nvt (total)) rehydrates to a smaller extent than the crystalline anhydride (that dehydrated in 0.85 mm of water vapor). This suggests that the irradiated sample (9.8×10^{5} n cm^{-2} nvt (total)) yields a crystalline anhydride under conditions where an unirradiated hydrate yields an amorphous anhydride. The irradiated dihydrate (9.8×10^{18} n cm^{-2} nvt (total)) when dehydrated in vacuo (150°C) exhibits an x-ray pattern virtually identical with that of the dihydrate when dehydrated in 0.85 mm of water vapor (85°C), whereas the unirradiated dihydrate did not give an x-ray pattern following dehydration in vacuo (150°C). (P.C.H.)

16097 ELECTRON SPIN RESONANCE STUDIES OF IRRADIATED POLYPROPYLENE. Lloyd J. Forrestal and William G. Hodgson (American Cyanamid Co., Stamford, Conn.). J. Polymer Sci., Pt. A, 2: 1275-80(Mar. 1964).

Polypropylene was irradiated at −196°C and its electron spin resonance spectra studied at temperatures between −196°C and room temperature. The intensity of the eight-line spectrum observed at −196°C corresponded to a G for radical production of 3.3. The spectrum could be reconstructed from theoretical curves assuming equal concentrations of radicals with four- and eight-line spectra. On warming to room temperature the radical concentration was reduced to 30% of the initial concentration. In experiments in which the sample was warmed to −100°C no change in radical concentration was observed. Annealing experiments at temperatures between −100°C and the glass transition temperature showed that at each temperature there was a rapid decay of radicals after which no further change in radical concentration took place. Above the glass transition temperature a continuous decay occurred. The onset of decay above −100°C may be associated with the onset of segmental motion in the amorphous regions of the polymer. The rapid decay of the radicals suggests that they are formed near each other as the results of hot hydrogen atom reactions. (auth)

16098 TEMPERATURE DEPENDENCE OF BIREFRINGENCE IN IRRADIATED POLYETHYLENE. E. Keneally, J. Gard, and G. Adler (Brookhaven National Lab., Upton, N. Y.). J. Polymer Sci., Pt. A, 2: 1463-9(Mar. 1964).

The birefringence of irradiated polyethylene was observed as a function of temperature. The data are consistent with a mechanism in which crosslinking limits the growth and annealing of crystallites. Crosslinks formed in material that was oriented at the time the crosslinks were formed, results in an oriented gel. This effect explains the birefringence and the persistence of nucleation sites at high temperatures. (auth)

16099 CRYSTALLITE SIZE DISTRIBUTION OF γ-RAY IRRADIATED POLYETHYLENES AS REVEALED BY FOURIER TRANSFORMATION OF LINE PROFILES. Masatake Mori (Tokyo Univ.) and Kenji Doi. Japan J. Appl. Phys., 3: 112-16(Feb. 1964).

The distribution changes in crystallite size in polyethylene exposed to γ-rays were followed by x-ray diffraction. Numerical calculation was carried out with the aid of an IBM 7090 computer. It was found that there was no significant difference between the distribution of an unirradiated sample and that of a 1×10^{9} roentgen irradiated one. After 3×10^{9} roentgen irradiation, the crystallites disappeared completely. (auth)

16100 INFRARED ABSORPTION SPECTRUM OF $NaNO_2$ SINGLE CRYSTALS AFTER GAMMA-RAY IRRADIATION. Kazuo Gesi and Yutaka Takagi (Japan Atomic Energy Research Inst., Tokyo). Japan J. Appl. Phys., 3: 126-7(Feb. 1964).

The change of absorption spectra of single-crystal $NaNO_2$ irradiated at room temperature with 3×10^{8} r of Co^{60} gamma rays, and measured with polarized infrared light is reported. (R.E.U.)

16101 PULSE RADIOLYSIS USING A CONSTRICTED AIR SPARK LIGHT SOURCE. C. L. Greenstock and E. Rollinson (Medical Coll. of St. Bartholomew's Hospital, London). Nature, 201: 812-13(Feb. 22, 1964).

Transient absorption spectra of various dilute aqueous solutions irradiated with a pulsed beam of electrons were investigated. The spectroscopic light source used is a modification of a constricted air spark source. Preliminary results were obtained with 10^{-2}M solutions of amino acids in pure distilled water, partially deaerated by bubbling with nitrogen. Solutions were irradiated with single pulses of 14-Mev electrons, 1.3 μsec long, delivering a dose of 9 kilorads. Short-lived absorption bands with lifetimes less than 1 msec were observed with glycine and alanine solutions. With glycine, two bands with peaks around 3100 and 3550 Å were detected. Alanine shows only a single broad band with a maximum around 3000 Å. (P.C.H.)

16102 A LINEAR ENERGY TRANSFER EFFECT IN THE RADIOLYSIS OF CYCLOHEXANE. W. G. Burns and J. R. Parry (Atomic Energy Research Establishment, Harwell, Didcot, Eng.). Nature, 201: 814(Feb. 22, 1964).

Degassed cyclohexane was irradiated with 1.5-Mev alpha particles from a Van de Graaff generator at currents of 0.01–0.1 μamp to doses of $2-6 \times 10^{19}$ ev g^{-1}. Although $G(H_2)$ varied only slightly from the value accepted for lightly ionizing radiation, G(cyclohexene) and G(bicyclohexyl) were considerably lower. Irradiations to the same total dose with gamma radiation (dose rate $2-7 \times 10^{17}$ ev g^{-1} min^{-1}, comparable with those in the irradiated zone in the alpha particle irradiations) gave essentially the same G values for these products. (P.C.H.)

16103 ANNEALING OF CHEMICAL RADIATION DAMAGE BY COMPRESSION. S. R. Mohanty and S. R. Upadhyay (Banaras Hindu Univ., Varanasi, India). Nature, 201: 921 (Feb. 29, 1964).

An experiment on gamma irradiated lead nitrate crystals is reported that indicates that compression directly induces recombination of damage fragments. (P.C.H.)

16104 PLATING RADIOACTIVE ZINC-65. David A. Rigney (Cornell Univ., Ithaca, N. Y.). Nature, 201: 1021 (Mar. 7, 1964).

A method is described for plating Zn^{65} on to a cathode. The bath composition is 0.05 g $ZnCl_2$, 2g NH_4Cl, 0.3 g $NaC_2H_3O_2$, 0.01 g gelatine, and 10 ml water. The effects of the small amount of nitric acid present in the tracer stock solution may be neglected, since the sodium acetate buffer is sufficient to maintain the proper pH. For electrodes, a platinum anode separated from a cadmium or tin cathode by 1 cm is used. Highest efficiencies are obtained for higher initial concentrations of zinc ion and for current densities near 2 m amp/cm^2. (P.C.H.)

16105 FORMATION OF 'MOLECULAR' HYDROGEN IN THE γ-RADIOLYSIS OF WATER VAPOUR. A. R. Anderson, B. Knight, and J. Winter (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 201: 1026-7(Mar. 7, 1964).

In the Co^{60} gamma radiolysis of water vapor in the presence of 0.054 mole % ammonia and >0.1 mole % oxygen (total pressure ~2 atm, temperature 120°C, dose rates 1.5 to 6×10^{17} ev g^{-1} H_2O min^{-1}), the production of molecular hydrogen was observed as a linear function of the dose. Under these conditions the rate of the reaction: $H + O_2 \rightarrow HO_2$ precludes the formation of molecular hydrogen by the combination of hydrogen atoms or by hydrogen atom abstruction reaction with the ammonia, and the results are, therefore, strongly indicative of a process leading directly to molecular hydrogen without hydrogen atom precursors. This postulate was confirmed by measurements with oxygen-free water vapor containing 0.94, 3.8, and 4.7 mole % C_6D_6 (>95% isotopic purity), under similar conditions of temperature, pressure, and dose rate. (P.C.H.)

16106 VOLUME EXPANSION AND COLOR CENTER BEHAVIOR OF NaCl X-RAY IRRADIATED AT LOW TEMPERATURE. S. Mascarenhas (Univ. of Sao Paulo, Brazil), D. A. Wiegand, and R. Smoluchowski. Phys. Rev., 134: A481-5(Apr. 20, 1964).

Volume expansion of x irradiated NaCl was measured in the range 15–90°K and its optical behavior was analyzed from 15 to 300°K. An improved photoelastic method showed that strain profiles agree with the shape predicted by the linear theory and that slow cooling (10°C per h) is essential to minimize background strain. Twenty-four hours of irradiation by 45 kv, 30 ma x rays at 15°K produces $\Delta V/V$ of the order of 10^{-5} which does not anneal below 80°K while, in contrast, the F band shows in this range one-stage annealing. Growth curves of the F band and of the 343-mμ band were made at 15°K. Annealing at 80°K followed by reirradiation at 15°K indicates that these bands recover quickly and a comparison with results on KCl and KBr suggests that the F centers are annihilated by hole capture. It follows also that in the range 15 to 80°K electronic changes in these centers do not lead to volume changes greater than the experimental error, $\Delta V/V \simeq 10^{-6}$. Heat-treated crystals presented a different behavior of thermal annealing of the F band with several annealing stages between 15 and 80°K. (auth)

16107 LOW-TEMPERATURE ANNEALING OF THE X-RAY-INDUCED VOLUME EXPANSION AND COLORATION OF LiF. S. Mascarenhas (Univ. of Sao Paulo, Brazil), D. A. Wiegand, and R. Smoluchowski. Phys. Rev., 134: A485-91(Apr. 20, 1964).

It has been shown previously that both $\Delta V/V$ and the density of F centers produced by x irradiation of LiF at 80°K anneal out partially near 130°K. Upon reirradiation at 80°K the F band quickly recovers while $\Delta V/V$ does not recover. In the present study, an additional annealing stage of $\Delta V/V$ and the F band was found near 270°K. Upon reirradiation at 80°K after annealing at 270°K, neither $\Delta V/V$ or the F band recover in contrast to the recovery after annealing at 130°K. The irreversibility of the 270°K annealing of the F band indicates vacancy annihilation which apparently does not occur at 130°K. The formation of M centers at the higher temperature suggests vacancy motion. The fractional annealing at 130°K was found to be smaller than in previous work, presumably because of different sample perfection before irradiation. (auth)

16108 ON THE COLORATION LAYER IN DEUTERON-IRRADIATED LiF CRYSTALS. P. Gorlich, H. Karras, and G. Kotitz. Phys. Status Solidi, 3: 2029-34(1963).

An investigation was conducted on the colored layers in LiF monocrystals produced by bombardment with 13.5 Mev deuterons. In specimens grown in a high vacuum and irradiated with $\sim 1.5 \times 10^{13}$ deuterons, absorption bands appeared at 248, 316, 378, 445, 550, 780, and 950 μmm. After irradiation the colored layer was removed in 34 steps and the absorption spectrum measured after each thickness decrement of 0.2 and 1 μmm. A description is given of a new method used to measure the thickness of the colored layers of the strongest bands at 248 μmm (F-band), 445 μmm (M-band), 316 μmm (R_1-band), and 378 μmm (R_2-band). No qualitative difference was found in the spectra at different sample depths. Assuming that the secondary processes are insignificant, the mean coloration depth (defined as the value at which the change of extinction reaches half the maximum value) is equal to the mean

penetration depth of the deuterons. The mean coloration depth of the F-, M-, R_1-, and R_2-bands was determined to be 0.655 ± 0.001 mm. A relationship was established between the thickness of the colored layer and the penetration depth of the deuterons. (AID Press, Vol. 2: No. 180, March 1964)

16109 RELATIVE FREQUENCIES OF ION CLUSTERS CONTAINING VARIOUS NUMBERS OF ION PAIRS. Aadne Ore and Arvid Larsen (Universitet, Oslo). Radiation Res., 21: 331-8(Mar. 1964).

The values observed by Wilson and by Beekman for the relative frequencies of occurrence of small radioinduced ion clusters containing various numbers of ion pairs are discussed. Reasons have been presented for considering the data of Beekman rather than those of Wilson representative of the true cluster frequencies. The merging by diffusion of clusters which stem from closely spaced primary ionizations was shown to offer a quantitative explanation of the discrepancy between the two sets of experimental data. (auth)

16110 THE ACTION OF X-RAYS ON DILUTE SOLUTIONS OF p-AMINOBENZOIC ACID. Karl Ford Nakken (Norwegian Radium Hospital, Montebello, Norway). Radiation Res., 21: 446-61(Mar. 1964).

The x-ray-induced hydroxylation of p-aminobenzoic acid (PABA) was studied in the presence and absence of oxygen, in neutral, and in 0.4 M sulfuric acid solution. The main product formed at pH 7.4 is 3-hydroxy-4-aminobenzoic acid (3-OH-PABA). There is no formation of p-aminosalicylic acid, but p-hydroxybenzoic acid and aniline are formed in trace amounts. In solutions flushed with pure O the yield of 3-OH-PABA was found to be 0.90 molecule/100 ev and the yield of total degradation 1.2 molecules/100 ev. In the absence of O these yields are reduced by a factor of 6. The data indicate that the degradation of PABA is due to OH radicals and that the O_2^- radical is participating only in dismutations. The strong effect of O is ascribed to the trapping of electrons and H radicals, which in anoxia might be participating in back reactions, thus repairing the target molecules. In 0.4 M sulfuric acid the yield of total degradation was found to be 1.1 molecule and 0.9 molecule/100 ev in the presence and in the absence of O respectively, whereas the yield of 3-OH-PABA was less than 0.2. The mechanism of degradation is discussed. (auth)

16111 PREPARATION OF ^{18}F IN A NUCLEAR REACTOR. M. Bresesti, A. M. Del Turco, and A. Ostidich (Euratom, Ispra, Italy). Radiochim Acta, 2: 49-52(Dec. 1963).

^{18}F was produced by irradiating $LiNO_3$ in the Ispra I reactor, by $^{16}O(t,n)^{18}F$ reaction using tritons from $^6Li(n,t)^4He$ reaction. A simple method is proposed for the purification of ^{18}F, based on the adsorption on anionic alumina in OH^- form and elution with NaF solution. Also the adsorption of ^{18}F on magnesium oxide was studied. Several other salts containing lithium and oxygen were irradiated. Some remarks on the dependence of the ^{18}F production yields from the chemical composition of the irradiated compounds are reported. (auth)

16112 THE SZILARD-CHALMERS EFFECT IN CYCLOHEXANE–IODIDE MIXTURES. P. F. D. Shaw (Oxford Univ.). Radiochim. Acta, 2: 76-85(Dec. 1963).

An attempt was made to estimate the number of radicals available for diffusive combination with the radioiodine produced by neutron capture in solvent systems. Reaction mechanisms used in the interpretation of the radiolysis of cyclohexane can also account for the chemical combination of such iodine atoms in cyclohexane-iodide mixtures. (auth)

16113 THE EFFECT OF γ-PRE-IRRADIATION ON RECOIL PHENOMENA IN CRYSTALS. Paul N. Dimotakis and Steven S. Kontis (Greek Atomic Energy Commission, Athens). Radiochim. Acta, 2: 85-9(Dec. 1963).

The γ-pre-irradiation effect on the recombination of recoil cobalt atoms in some neutron irradiated crystalline cobaltic complexes was examined. The introduction of defects into the lattice by pre-irradiation seems to increase the initial retention and promotes the annealing phenomenon, though on the other hand radiolytic phenomena may also appear. Plots of isothermal annealing curves appear to indicate the existence of two or more parallel consecutive recombination-decomposition reactions. A kinetic interpretation of such mixed phenomena is also given. Complex kinetic phenomena also appear to be quite general in annealing processes for systems already studied by others. These systems, if examined in this light, may lead to a new interpretation as to the way in which recombination occurs during annealing. (auth)

16114 RETENTION AND ANNEALING REACTIONS IN DICHROMATES. N. Getoff and A. G. Maddock (Univ. of Cambridge, Eng.). Radiochim. Acta, 2: 90-3(Dec. 1963).

A comparison of the thermal, radiation, and ultraviolet annealing of neutron irradiated potassium and ammonium dichromates is reported. Although substantial thermal annealing is possible in the ammonium salt the process is eventually limited by gross thermal decomposition. Ultraviolet irradiation of the neutron irradiated salts leads to a reduction in retention in the ammonium salt. This is explained in terms of a photochemical reaction between the CrO_2^{2+} fragment and the ammonium ions or their photolytic product. (auth)

16115 SOME OBSERVATIONS ON THE SZILARD-CHALMERS PROCESS IN DICHROMATES. T. Andersen and A. G. Maddock (Univ. of Cambridge, Eng.). Radiochim. Acta, 2: 93-6(Dec. 1963).

The initial retentions of samples of monoclinic and triclinic potassium dichromate, irradiated under the same conditions were found to be 82.4 and 89.5% respectively. Monoclinic solid solutions of $K_2Cr_2O_7$ in $(NH_4)_2Cr_2O_7$, in the range 0–65 mole % of $K_2Cr_2O_7$, gave initial retentions that were a smooth, though not linear, function of the composition. The curve could be extrapolated to the value found for the metastable pure monoclinic $K_2Cr_2O_7$. Unlike $(NH_4)_2Cr_2O_7$, the tetramethyl ammonium salt did not show a decrease in retention on irradiation with ultraviolet light. The photolytic decrease in retention in the ammonium salt does not appear to be thermally reversible. An entirely non-aqueous method of determining the retention in ammonium dichromate gave the same value as the aqueous procedure. (auth)

16116 CONTRIBUTION TO THE RADIATION CHEMICAL-THERMAL DECOMPOSITION OF HYDROCARBONS. Gábor Foeldiák, Werner Meder, and Guenther O. Schenck (Max-Planck-Institut für Kohlenforschung, Mülheim an der Ruhr, Ger.). Radiochim. Acta, 2: 105-6(Dec. 1963). (In German)

Studies on the radiochemical-thermal decomposition of hydrocarbons were extended to include a strong gamma source and the temperature range from 20 to 400°C in order to determine the energy yield, chain length, and activation energy of the processes in radiochemical-induced cracking of hydrocarbons. (M.C.G.)

16117 EFFECTS OF HIGH-FREQUENCY DISCHARGE ON ADSORPTION PROPERTIES OF SILICAGELS AND ZEOLITES. S. V. Starodubtsev, Sh. A. Ablyaev, S. E. Ermatov, and U. U. Pulatov. p.11-18 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Effects of slow electron bombardment on the adsorption properties of synthetic Zeolytes and silica gels were studied. It was found that adsorption by Zeolytes improved under irradiation, reaching saturation after 6 to 10 min of exposure. Adsorption by silica gel reached a maximum following 8 to 15 min of exposure. Experiments at various temperatures indicated improved adsorptive properties in both materials at lower temperatures. (R.V.J.)

16118 EFFECTS OF γ RADIATION ON ADSORPTIVE PROPERTIES OF SYNTHETIC ZEOLITES. S. V. Starodubtsev, Sh. A. Ablyaev, S. E. Ermatov, and S. A. Azizov. p.19-21 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Gamma irradiation of Zeolytes at 150 to 350 kr/hr to total doses of 2 to 3 Mr increased adsorption, especially at lower temperatures. Isotherms for adsorption by irradiated and unirradiated Zeolytes between liquid nitrogen and room temperatures were constructed. (R.V.J.)

16119 ON THE MECHANISM OF RADIOLYSIS OF CERTAIN SOLID INORGANIC COMPOUNDS. I. M. Blaunshtein. p.22-31 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Radiolysis studies indicate that NaCl, KCl, and KI are stable to γ radiation while $BaCl_2$ decomposes, emitting chlorine. The results show that radiolysis is closely related to structural deficiency, i.e., that potentially deficient structures decompose easier – polycrystalline specimens decomposing easier than monocrystalline. (R.V.J.)

16120 OBSERVATIONS OF LOW-TEMPERATURE LUMINESCENCE OF CRYSTALLINE QUARTZ IRRADIATED BY PROTONS IN A VACUUM CRYSTAL. S. V. Starodubtsev, G. S. Spirin, and M. Yunus. p.38-42 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

An analysis of thermoluminescence curves for quartz crystals irradiated with 80-kev proton near liquid nitrogen temperature revealed four peaks at 120, 200, 237, and 256°K. Peak I is about 5 to 6 fold brighter than peak II. Following further exposure peaks I, III, and IV became depressed and peak II increased. A small increase in temperature during irradiation completely eliminated peak I. (R.V.J.)

16121 EFFECTS OF ELECTRIC TREATMENT ON THE LUMINESCENCE OF SYNTHETIC QUARTZ. Sh. Vakhidov. p.43-4 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Effects of electric treatment on the luminescence of Ge-doped synthetic quartz irradiated at 600 r/sec with γ rays were investigated. The results showed that synthetic Ge-doped and natural crystals react differently. Under irradiation at 100° and over the natural crystals lose their color centers and thermoluminescence. At –60 to –196° the thermoluminescence intensity increased. At –30 to –40° the thermoluminescence was increased in both natural and synthetic crystals. (R.V.J.)

16122 EFFECTS OF NUCLEAR EMISSION ON SILICON CARBIDE LUMINESCENCE. V. I. Zvyagin, E. M. Lobanov, A. G. Dutov, G. V. Leushkina, and R. Maksumov. p.50-5 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

An activation analysis was used for determining admixtures in hexagonal (α – SiC) and cubic (β – SiC) crystals using their luminescence spectra. Irradiation with 5×10^8 r of γ rays produced no luminescence variations in the silicon carbide (green, yellow, light yellow, and red) spectra, showing that the luminescence spectrum is not determined by the crystal structure but by the chemical elements. A γ spectrometer with a 50 × 40 mm NaI(Tl) crystal, FEU-43 photomultiplier and 100-channel amplitude analyzer was used for measuring the activity of a specimen irradiated with 1.8×10^{13} n/cm^{-2} sec for 5 hours. The positions of photopeaks indicated the presence of Na^{24}, Ga^{72}, and Ta^{180}. Luminescence was completely extinguished following irradiation with 2×10^{17} n/cm^2. (R.V.J.)

16123 ON THE THEORY OF RADIATION INDUCED DESTRUCTION OF LINEAR POLYMERS. L. G. Gurevich. p.123-5 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

A method is given for determining the molecular-weight distribution in irradiated molecular chains. (R.V.J.)

16124 EFFECTS OF γ RADIATION ON DIELECTRIC PROPERTIES OF TRIGLYCINE SULFATE CRYSTALS. S. V. Starodubtsev and E. V. Peshikov. p.126-8 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

The influence of γ rays on the dielectric properties of triglycine sulfate in weak fields was investigated. Dielectric losses of 10 × 10 × 1 mm plates exposed to γ rays at 0.4×10^6 r/hr at 20.5°C were measured. It was found that dielectric losses were halved after the first two hours of irradiation and remained unchanged thereafter. (R.V.J.)

16125 EFFECTS OF X AND γ RADIATION ON STRUCTURAL CHANGES IN CADMIUM SULFIDES. O. R. Niyazova and M. A. Kaneev. p.141-2 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Microscopic studies revealed surface changes in cadmium sulfide irradiated with 30-kw x rays and γ rays. It was observed that the changes were followed by a change from a bright to a weak yellow color with metallic spots and a loss of crystal transparency. Annealing and mechanical treatment re-established the original properties. (R.V.J.)

16126 PROCESS FOR THE PRODUCTION OF DEUTERIUM ENRICHED AMMONIA. (to Commissariat à l'Energie Atomique). British Patent 952,335. Mar. 18, 1964. Priority date June 8, 1959, France.

A process for enriching ammonia in deuterium by single temperature isotopic ammonia-hydrogen exchange is described. The exchange takes place between liquid ammonia and hydrogen containing deuterium in the presence of a catalyst such as potassium amide, cesium amide, or rubidium amide, which is dissolved in the liquid ammonia. The catalyst circulates in a cycle to and from the reaction vessel, wherein, in order to reduce the concentration of deuterium recycled with the catalyst from a point of the cycle that is rich in deuterium to a point of the cycle that is pure in deuterium, at least one catalyst recycling loop is associated with the reaction vessel. In this loop the catalyst solution leaving the reactor is either partially evaporated and subjected to isotopic exchange with deuterium-poor ammonia synthesis gas, or completely

evaporated. The resulting catalyst is then reinjected into the ammonia fed to the reactor. (M.C.G.)

16127 RADIATION RESISTANT MINERAL OILS. (to Esso Research and Engineering Co.). British Patent 952,859. Mar. 18, 1964. Priority date Nov. 23, 1959, United States.

A mineral oil of improved resistance to deterioration due to gamma radiation was prepared by adding a combined amount of from 0.0075 to 0.5 wt % of a liquid scintillation phosphor capable of absorbing gamma radiation and a compound capable of absorbing ultraviolet light to the oil. The compound used to absorb the ultraviolet light was 2,2 dihydroxy-4-methoxy benzophenone. (M.C.G.)

Separation Processes and Procedures

16128 (NYO-9324) FOAM SUPPRESSION OF RADIOACTIVE IODINE AND PARTICULATES. Robert E. Yoder, Mario H. Fontana, and Leslie Silverman (Harvard Univ., Boston. Air Cleaning Lab.). Feb. 25, 1964. Contract AT(30-1)-841. 34p.

A reliable, efficient, and economical method is needed to remove radioactive halogens such as iodine and bromine and particulates from air in many atomic energy installations. One method developed which is particularly suited to reactor containment vessels or other large confined areas is foam containment. In this method an ether lauryl sulfate foam containing an iodine reactant is generated, rapidly filling the entire containment volume. This provides a tremendous surface area to which the encapsulated gases and particles can diffuse and be removed. A series of tests were conducted in a 6,000 cubic foot hot cell to measure iodine and particle removal from contaminated air by foam. Ten curies of elemental iodine-131 and sufficient carrier iodine to simulate a reactor inventory concentration, were released in the cell. The gaseous radioactivity decay by ventilation loss and wall adsorption was measured. The equilibrium concentration level of iodine-131 in the no-foam test was 32% of the initial level; this equilibrium was reached in 110 minutes. In the foam tests, in which the cell was filled with foam immediately after the iodine release, the equilibrium concentration level was 10% of the initial value and was reached in seventy minutes. Two experiments were performed by burning an irradiated uranium foil and filling the cell with foam. The only activity detected was iodine-131 which in the presence of uranium dioxide particulates did not decay to an equilibrium level but decreased linearly with time. In 150 minutes, the air activity was 35% of the initial concentration. This method of gas cleaning is effective in collecting iodine-131 and converting it to a non-volatile form. The foam is readily collapsed by water sprays and the air borne iodine collected by the foam is transferred to the liquid phase for treatment. Work on particulate removal indicates over 90% reduction, as compared to settling, within a few minutes following the foam treatment. (auth)

16129 (RAI-116) THE REMOVAL OF METALLIC IONS BY FOAMING AGENTS AND SUSPENSIONS: LABORATORY AND ENGINEERING STUDIES. Annual Report, July 1, 1962 to June 30, 1963. Eliezer Rubin, Ernest Schonfeld, and Jacques Weinstock (Radiation Applications Inc., Long Island City, N. Y.). Dec. 16, 1963. For Oak Ridge National Lab., Tenn. Contract W-7405-eng-26, Subcontract 2024. 47p.

It was shown that two processes involving foam separation may be used to remove ^{90}Sr from low-activity waste (LAW) solutions: pretreatment with NaOH and Na_2CO_3, followed by foam separation and simultaneous phosphate-iron coagulation, froth flotation, and foam separation. Foam-separation processing of ORNL LAW without pretreatment of any kind resulted in very low decontamination factors (DF's) for strontium. Pretreatment of ORNL LAW by pH adjustment followed by foam separation required very long waiting periods, prior to filtration and foaming, to achieve high DF's. Further evaluation and development of the $NaOH-Na_2CO_3$ pretreatment process, using a 9-inch-diameter suspended-bed scavenger and actual ORNL LAW at flow rates of 10 to 60 gal-hr^{-1}-ft^{-2} resulted in decontamination factors of 10 to 15 for ^{90}Sr and effluent total hardness of 2.0 to 4.5 ppm. This may be compared with decontamination factors of 3 to 4 for ^{90}Sr and total effluent hardness of 35 to 60 for the present ORNL lime-soda process with the normally used feed flow rate of 21 gal-hr^{-1}-ft^{-2}. Pretreatment of synthetic LAW by this process followed by foam separation resulted in overall Sr^{2+} decontamination factors of over 15,000. Similar experiments with actual ORNL LAW gave overall Sr^{2+} DF's of approximately 300. The combination of phosphate-iron coagulation and foam separation into a one-step continuous process resulted in run-average decontamination factors up to 2000 for strontium. This highest average DF was obtained for a 7-hour experiment conducted in a continuous apparatus and using synthetic ORNL LAW at a flow rate of 25 gal-hr^{-1}-ft^{-2}, air to feed flow rate ratio of 12.4, 67 mg/l PO_4^{3-} and 23.4 mg/l Fe^{2+} as coagulating agents, 90 mg/l dodecylbenzenesulfonate (DBS) as a foam separation agent, and 15 mg/l Armeen Z as a floating agent. An incomplete evaluation of this process indicated that: a 7-minute residence time in the mixing beaker, prior to foaming, results in lower Sr^{2+} DF's than residence times in the range of 17 to 23 minutes; higher DBS concentration may be required for treating actual ORNL-LAW than those required for synthetic LAW; intermittent addition of grundite clay into the mixing beaker, in addition to PO_4^{3+}, Fe^{2+}, Armeen Z, and DBS, prior to foaming produced only very low decontamination factors for Cs^+; and the use of split surfactant feed produced average Sr^{2+} DF's of up to 580 with actual ORNL LAW solutions as feed. (auth)

16130 (EURAEC-789) RETREATMENT OF IRRADIATED FUELS. Quarterly Report No. 13, April 1–June 30, 1963. (Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium). Work Performed under United States–Euratom Joint Research and Development Program. Contract 098-62-11-RDB. 46p. (A translation).

Studies were made on the fluorination of uranium and plutonium oxides derived from mixed oxides. The hydrofluorination rate of a mixture of U_3O_8 and PuO_2 was in the same range as that of UO_2 up to contents of 10% Pu. Above 10% the reaction rate decreased appreciably. The rate at which UF_6 was volatilized by ClF_3 at 105°C apparently included a rapid stage corresponding to the fluorination of UF_4 and a slower stage corresponding to that of UO_2F_2. In addition, UF_6 was formed more quickly the lower the plutonium content. Plutonium volatilization under the action of ClF_3 was not witnessed. Tests on the oxidation of UO_3-PuO_2 mixtures are continuing satisfactorily for plutonium concentrations of 3 to 40%. Fluorination with SF_4 of the UO_3 derived from this reaction was slow and gave rise to green deposits inside and outside the reaction zone. These deposits were easily eliminated by ClF_3

at 300°C. Plutonium volatilization under the action of SF_4 and ClF_3 at 300°C was not observed. Some PuF_6 was prepared by a reaction between PuF_4 and fluorine at 600°C. Its transfer was studied. The presence of fissium (2% in oxide form sintered with UO_2) caused the oxidation rate of UO_2 by air to be slowed down. The oxidation, hydrofluorination, and fluorination reactions were studied with quantities of 2 to 3 kg. On this scale it was necessary to prolong the oxidation time. Hydrofluorination did not set any particular problems; continuous sampling enabled "conversion degree–time" graphs to be established for the various operational conditions. Fluorination into UF_6 on a large scale will necessitate fluorine recycling. Various studies with a view to improving fluidization conditions and the scrubbing of gaseous effluents were carried out. Research into the conversion of uranium fluorides into UO_2 in molten salts, let to a product with the desired density and stoichiometric properties necessary for refabrication. PCl_5 was used to chlorinate the uranium oxides. This reaction produced $POCl_3$ which forms volatile, and distillable, complexes with zirconium and niobium chlorides. This results in a definite decontamination in both these elements. (auth)

16131 SEPARATION OF URANIUM, THORIUM, AND THE RARE EARTHS ELEMENTS BY ANION EXCHANGE. Johann Korkisch (Universität, Vienna) and Gustaf Arrhenius. Anal. Chem., 36: 859-4(Apr. 1964).

A method is described for the simultaneous quantitative separation of uranium, thorium, the rare earth elements, yttrium, cadmium, lead, and bismuth by means of anion exchange in a nitric acid-acetic acid medium. The anion exchanger employed is the strongly basic resin Dowex 1, X8 (nitrate form). The elements concerned are strongly adsorbed on the resin from a medium consisting of 90% glacial acetic acid and 10% 5N nitric acid. All other elements investigated including iron, aluminum, magnesium, and calcium pass into the effluent and are thus quantitatively separated. For the development of this method measurements of the distribution coefficients were carried out for numerous elements as a function of varying concentrations of nitric acid, acetic acid, and of the elements in question. Analogous experiments were performed in propionic acid media for the sake of comparison. The method was developed particularly for the analysis of marine sediments. A standard sample of homogenized deep sea clay was used as test material. (auth)

16132 ANION EXCHANGE SEPARATION OF CALCIUM AND STRONTIUM. James S. Fritz, Hirohiko Waki, and Barbara B. Garralda (Iowa State Univ., Ames). Anal. Chem., 36: 900-3(Apr. 1964).

A new anion exchange method for separation of calcium and strontium was developed using the mixed solution of 0.25M nitric acid and 95% (v/v) methyl alcohol as the eluent. Magnesium, calcium, and strontium (total volume 1 mmole) were separated quantitatively from each other with a 22-ml column of the Amberlyst XN-1002 nitrate form. Even the separation of the sample of Ca/Sr = 500 showed fairly satisfactory results for the strontium content. (auth)

16133 LEACHING-OUT URANIUM AND RADIUM FROM CLAYS. G. Kh. Efendiev and A. N. Nuriev. Azerb. Khim. Zh., No. 4, 103-7(1963).

Water containing $NaHCO_3$ or $CaCl_2$ (0.5 N solution) was found to extract uranium to the extent of $1.4 \cdot 10^{-2}$% in clay from the Maykopskaya bed. Increased concentrations of Na, Mg, and Ca chlorides in the solutions result in lower extraction of uranium, due to precipitation as $Ca_2[UO_2(CO_3)_3]$. $CaCl_2$, $MgCl_2$, and NaCl were found to promote radium leaching ability at normalities up to 3.0. Uranium recovery was found to be favored by $NaHCO_3$ over chloride solution use. (OTS)

16134 THE EXTRACTION OF SCANDIUM BY MIXTURES OF OXINE AND NEUTRAL ORGANOPHOSPHORUS REAGENTS. P. G. Manning and Pranowo (Dept. of Mines and Technical Surveys, Ottawa). Can. J. Chem., 42: 708-10(Mar. 1964).

Studies were made on the two-phase liquid-liquid systems Sc^{3+}–HCl–HX–TOPO–hexone and Sc^{3+}–HCl–HX–DBBP–hexone at 25°C where HX is oxine, TOPO is trioctylphosphine oxide, and DBBP is dibutyl butyl phosphonate. Experiments were also conducted with TBP, which, however, failed to produce a synergic reaction. In the case of DBBP and TOPO, steric hindrance and extractive power are balanced. Extraction occurs via the formation of the complex $ScClX_2S_2$. (P.C.H.)

16135 GAS-SOLID REACTION IN A FLUIDIZED BED. P. N. Rowe (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. Eng. Progr., 60: No. 3, 75-80(Mar. 1964).

The hydrodynamics of gas fluidized beds are briefly reviewed. As an illustration of the relevance of this to chemical reactor, the continuous hydrofluorination of UO_2 in a two-stage fluidized bed is considered. It is shown that recently discovered hydrodynamic details of a bubbling gas fluidized bed lead to a logical model that can be used for design purposes. An example is used to show that particle size may be a particularly important parameter. Small particles may be a disadvantage, possibly because they result in a high value for the bubble-to-gas velocity ratio. (P.C.H.)

16136 THE RECOVERY OF FISSION PRODUCT KRYPTON FROM NUCLEAR FUELS. R. F. Taylor (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Ind. Chemist, 39: 358-64(July 1963).

The development of a process for recovering Kr^{85} from off-gases resulting from the dissolving of spent uranium fuel elements is described. Processes for concentration and purification of the recovered gas are included, and details of the plant required are outlined. (P.C.H.)

16137 SEPARATION OF LANTHANIDES IN AMMONIUM NITRATE BY MEANS OF ZONE CRYSTALLIZATION. [PART] III. V. K. Val'tsev, E. G. Avvakumov, M. F. Pyr'ev, and L. Kh. Kravchenko (Inst. of Inorganic Chemistry, Siberian Branch, Academy of Sciences, Novosibirsk). Izv. Sibirsk. Otd. Akad. Nauk SSSR, No. 3, 152-4(1963). (In Russian)

An attempt was made to separate lanthanides by means of zone crystallization using ammonium nitrate as solvent and ammonium sulfate or ammonium oxalate as precipitating agents. A series of experiments with various amounts of lanthanides in ammonium nitrates showed that lanthanides that require the least ammonium sulfate precipitate first, with lanthanide precipitation in reverse order to the order during partial precipitation without precipitant. The differences are used in the separation process for pairs of lanthanides. Illustrations are given for the pairs La–Sm and Nd–Er in the sulfate system and for the mixture Sm–Gd–Yb in the oxalate system. (R.V.J.)

16138 AN APPROACH TO KINETIC STUDIES USING RADIOCHROMATOGRAPHY ON THIN LAYERS. PART I. C. J. Moye (C.S.R. Research Labs., Sydney). J. Chromatog., 13: 56-60(Jan. 1964).

The construction of two instruments, a simple scanning unit for thin-layer chromatograms and a modified spreader for obtaining very uniform thin layers, is described. (auth)

16139 CHROMATOGRAPHY ON PAPER IMPREGNATED WITH ION EXCHANGE RESINS. IX. THE ADSORPTION OF METAL IONS FROM HCl ON ANION-EXCHANGE RESIN PAPER, DEAE PAPER AND AMINOETHYL-CELLULOSE PAPER. M. Lederer and L. Ossicini (Istituto di Chimica Generale ed Inorganica, Rome). J. Chromatog., 13: 188-93(Jan. 1964).

The adsorption of metal ions for HCl onto SB-2 resin paper, DE-20, and AE-30 cellulose anion-exchange papers was studied and the mechanism of adsorption discussed considering the differences observed between the various exchangers. (auth)

16140 CHROMATOGRAPHY ON ION EXCHANGE PAPERS. X. SOME DATA FOR CELLULOSE ION-EXCHANGERS WITH ORGANIC SOLVENTS. M. Lederer and V. Moscatelli (Istituto di Chimica Generale ed Inorganica, Rome). J. Chromatog., 13: 194-8(Jan. 1964).

The adsorption of numerous inorganic ions on various cellulose exchangers from mixtures of HCl and organic solvents was studied. As an ion exchange resin the adsorption depends on various factors and cannot be interpreted in terms of true ion exchange. The results indicate that the use of organic solvents in conjunction with cellulose exchangers can have numerous analytical possibilities. (P.C.H.)

16141 REVERSED-PHASE CHROMATOGRAPHY OF ALKALI METALS AND ALKALINE EARTHS ON PAPER TREATED WITH DI(2-ETHYLHEXYL) ORTHOPHOSPHORIC ACID IN ACETATE MEDIUM. E. Cerrai and G. Ghersini (C.I.S.E., Segrate, Italy). J. Chromatog., 13: 211-23 (Jan. 1964).

The chromatographic behavior of alkali and alkaline earth metals on paper treated with di(2-ethylhexyl) phosphoric acid (HDEHP) was investigated, using acetic acid as the eluent in the range of concentrations from 2 to 0.01 M. The quantity ($1/R_F = 1$) was related to the hydrogen ion concentration and to the effective HDEHP concentration on the paper. A behavior similar to that shown in liquid–liquid extraction with HDEHP solutions was found provided that the acetic acid concentration was kept low. The peculiar behavior found with concentrated acetic acid is discussed. No direct proportionality was obtained between the HDEHP molarity in the solution used to treat the paper and the effective concentration of HDEHP on the paper, which acts during elution. The instability of HDEHP on paper with very concentrated acetic acid was also investigated. Some chromatographic separations of alkali and alkaline earth metals were carried out, and others were suggested. (auth)

16142 QUANTITATIVE INORGANIC CHROMATOGRAPHY. XI. THE CHROMATOGRAPHIC SEPARATION AND AUTOMATIC FLAME SPECTROPHOTOMETRIC DETERMINATION OF THE ALKALINE EARTH METALS USING α-HYDROXYISOBUTYRIC ACID. F. H. Pollard, G. Nickless, and D. Spincer (Univ. of Bristol, Eng.). J. Chromatog., 13: 224-31(Jan. 1964).

An ion exchange separation of submilligram quantities of alkaline earth metals was developed using α-hydroxyisobutyric acid as eluting agent and automatic flame spectrophotometric determination. (auth)

16143 RADIATION EFFECTS ON THE EXTRACTIONS AND EXTRACTANTS. Jiří Teplý and Igor Janovský (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Rez). Jaderná Energie, 10: 40-6(1964). (In Czech)

Radiation effects on extraction process and extractants are reviewed, and a general analysis presented on the problem and the data of radiation doses occurring in the extraction of irradiated nuclear fuel. The results of radiochemical investigations of aqueous solutions of uranium and plutonium compounds and the results of radiation stability investigations of tributylphosphate and other extractants are reported. A review of the influence of tributylphosphate damaged by radiation on the extraction of uranium, plutonium, and fission products is given. (auth)

16144 THE Zr^{95}–Nb^{95} SEPARATION FROM FISSION PRODUCT SOLUTION BY THE SORPTION ON SILICA GEL. Josef Krtil, Vaclav Kouřím, Jaroslava Zemanová, and Helena Pánková (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Rez and Prague). Jaderná Energie, 10: 47-51(1964). (In Czech)

The possibility of quantitative Zr^{95}–Nb^{95} isolation on silica gel was investigated for dependence on nitric acid concentration and silica gel grain size. The elution of microamounts and macroamounts of zirconium from the silica gel column was also investigated. The capacity for zirconium in a dynamic set of conditions and the retention after many sorption-elution cycles were found. The sorption of other long-lived fission products such as Cs^{137}, Ce^{144}, Sr^{90}, and Ru^{106} present in wastes from nuclear fuel recovery was investigated under the same set of conditions. (auth)

16145 USE OF COPOLYMERIZED CELLULOSES IN CHROMATOGRAPHY. J. R. A. Anderson, S. Dilli, J. L. Garnett, and E. C. Martin (Univ. of New South Wales, Sydney). Nature, 201: 772-4(Feb. 22, 1964).

An examination of copolymerized celluloses showed distinct advantages over conventional chromatographic materials. In particular, the modified celluloses exhibited an appreciable increase in wet-strength and were unaffected by the acids, bases, and organic solvents commonly used in chromatography. A systematic evaluation of grafted celluloses was undertaken with a view to examining compounds amenable to reversed-phase chromatography such as steroids, sugar acetates, and 2,4-DNP derivatives. Preliminary results with dyes, metal ions, and fatty acids are reported. Data are tabulated. (P.C.H.)

16146 DEVELOPMENT OF APPARATUS FOR FAST LIQUID-LIQUID EXTRACTION. L. Koch, H. Muenzel, and H. Thoma (Kernforschungszentrum, Karlsruhe, Ger.). Radiochim. Acta, 2: 33-6(1963). (KFK 189). (In German)

Descriptions are given of several types of apparatus for fast liquid-liquid extraction that is also applicable in hot cells. Discontinuous extractions in laboratory scale can be done in 10–20 seconds. The desired separated phase is, especially when one of the models with a valve is used, absolutely free from the undesired one. The apparatus can also be used for continuous extractions. (auth)

16147 RAPID SOLVENT EXTRACTION METHODS FOR FISSION PRODUCT SEPARATION AND ANALYSIS. PART I. SEPARATION AND ANALYSIS OF VARIOUS CONSTITUENTS OF IRRADIATED FUELS. PART II. RAPID METHOD FOR ^{95}Zr ESTIMATION. T. V. Healy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Radiochim. Acta, 2: 52-7(Dec. 1963).

A new, quick, and efficient solvent extraction method of separating various constituents from irradiated fuel samples was evolved. In this method, the following groups are isolated, using diethyl hexyl phosphoric acid, (HDEHP) as solvent: (1) Ru, Cs, Sr, Ba; (2) Ce; (3) Y plus rare earths; and (4) Zr and Nb. Further solvent extraction methods are used for separation of individual elements.

A rapid method is described for the extraction and estimation of zirconium-95 from fission product solution utilizing HDEHP. The fission products are normally in nitric or hydrochloric acid solution but extractions from sulfuric acid solutions are also described. The method usually takes half an hour and an accuracy of ±1% is obtained. (auth)

16148 RADIOCHEMICAL SEPARATION OF THALLIUM BY AMALGAM EXCHANGE. Iqbal H. Qureshi and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Radiochim. Acta, 2: 99-103(Dec. 1963). (TID-18923)

The radiochemical separation of thallium by an amalgam exchange technique was critically evaluated for the aqueous 0.5M sodium nitrate system. With an optimized procedure, thallium yields of more than 95% were obtained while yields of contaminants, in most cases, were less than 0.1%. The yield is relatively insensitive to interferences from mineral acids, alkalies, and salts, except for halogen acids, sulfites, and oxidizing agents. At room temperature the procedure requires about 6 minutes while at 50°C it can be carried out in only 4 minutes. The application of this method to the separation of radiothallium in the presence of fission products requires about 8 minutes. The procedure appears to have useful potential for the separation of short-lived isotopes of thallium and can readily be modified for the determination of small amounts of thallium in various samples when used in conjunction with neutron activation analysis. (auth)

16149 FAST SEPARATION OF ANTIMONY FROM IRRADIATED ENRICHED TELLURIUM. Sara M. Abecasis (Universidad Nacional, La Plata). Radiochim. Acta, 2: 103-4(Dec. 1963).

A fast chemical method was worked out for the separation of antimony from irradiated enriched tellurium, making it possible also to recover the target tellurium for successive irradiations. The total separation time is about 15 min. The radiochemical procedure in which a pure antimony activity is obtained is described. (P.C.H.)

16150 REACTOR FUEL PROCESSING. Volume 7, No. 1. (Argonne National Lab., Ill.). Winter 1963-64. $0.70(GPO) (domestic), $0.90(GPO) (Foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC).

Progress in reactor fuel processing is reviewed under the following topics: commercial aspects of fuel processing, research and development on aqueous processing, research and development on nonaqueous processing, waste disposal, and production of uranium, thorium, plutonium, and their compounds. Separate abstracts were prepared for each topic. (M.C.G.)

For abstracts of individual items see: 16049, 16151, 16152, 16153, and 17350.

16151 COMMERCIAL ASPECTS OF FUEL PROCESSING. Reactor Fuel Process., 7: No. 1, 1-7(Winter 1963-64).

Locations and some of the important characteristics of fuel processing plants are listed. Developments in the transportation of irradiated fuel are described. Economics of fuel processing for the thorium fuel cycle and the uranium fuel cycle are discussed. Studies of hazards associated with large radiochemical plants are outlined. (12 references). (M.C.G.)

16152 RESEARCH AND DEVELOPMENT ON AQUEOUS PROCESSING. Reactor Fuel Process., 7: No. 1, 8-21 (Winter 1963-64).

Work on the development of aqueous fuel processing was found to be concerned principally with preparation of nonmetallic fuels for processing and the application of solvent-extraction techniques. Mechanical dejacketing, chop-leach processing, oxidation of graphite-matrix fuels, hydrolysis of uranium carbide fuels, dissolution of Zr–U alloy in hydrofluoric acid, and corrosion of dissolver construction materials are discussed. Plutonium polymerization, TBP solvent deterioration, and fission-product behavior in solvent-extraction processes are described. A TBP process for Al–Pu alloy fuel is outlined. Plant equipment design and operation are discussed. (29 references). (M.C.G.)

16153 RESEARCH AND DEVELOPMENT ON NONAQUEOUS PROCESSING. Reactor Fuel Process., 7: No. 1, 22-53(Winter 1963-64).

Development of methods for processing reactor fuel elements based on the relative volatility of chlorides is reviewed. Dry halogenation processes, fluid-bed fluorination processes, preparation and properties of uranium and plutonium fluorides, and fused-salt volatility processes are described. Pyrometallurgical processes are discussed, including melt-refining process technology, purification of metals by various melting techniques, development of liquid-metal and salt processes, fundamental studies relative to liquid-metal process development, and construction materials for liquid-metal systems. Other nonaqueous methods for processing oxide and carbide fuels are outlined. (96 references). (M.C.G.)

16154 IMPROVEMENTS IN OR RELATING TO THE BENEFICIATION OF BERYLLIUM ORES. Douglas Newlands Moir and Henry Christopher Curwen (to United Kingdom Atomic Energy Authority). British Patent 952,246. Mar. 11, 1964. Filed Jan. 24, 1962.

A flotation process is given for the beneficiation of low-grade beryl ores (≤ 0.2% beryllia). The process comprises conditioning the ore with acid fluoride, washing the same, adding oleic acid, adjusting the pH to between 6.5 and 7.5, and floating a beryl concentrate from the cold pulp. The underflow from the flotation may be treated with more oleic acid and some oil and a further flotation carried out. Soft water should be used in the process. Two examples of the process and the results obtained are given. (D.L.C.)

16155 IMPROVEMENTS IN ION EXCHANGE METHODS OF SEPARATING ZIRCONIUM AND HAFNIUM. Gaston Charlot, Jacques Hure, Bernard Tremillon, and Rose Saint James (to Commissariat à l'Energie Atomique). British Patent 952,927. Mar. 18, 1964. Priority date Apr. 19, 1960, France.

A method of separating hafnium and zirconium from a material by ion exchange is described. The material is dissolved in 0.1 to 4M H_2SO_4 and passed on to the resin after it is charged with the bisulfate anion HSO_4^-. The resin is then developed by displacement using a sulfuric solution of a zirconium salt and the hafnium thus displaced is recovered. The resin, freed of its hafnium, is regenerated by elution with sulfuric acid. At least a part of the zirconium free of hafnium is obtained in the eluant. Examples of the use of the method are given. (M.C.G.)

16156 PROCESS AND APPARATUS FOR SEPARATION OF GAS MIXTURES THROUGH THE EFFECT OF CENTRIFUGE FORCE. Hans-Georg Noeller. German Patent 1,154,793. Sept. 26, 1963. Filed Jan. 4, 1956. (In German)

A method is described for the separation of gas mixtures by the action of centrifugal force. One of the gas jets containing the gas mixture to be separated is directed into a container of circular cross section in a tangential direction

causing a circular flow with such a high velocity that, under the action of the centrifugal force which depends on the kind of gas, an enrichment of the gas molecules of the heavier constituent occurs in the circular path, and the lighter constituent is more concentrated in the center of the container. (M.C.G.)

16157 METHOD OF SOLVENT EXTRACTION. Nathan E. Ballou. U. S. Patent 3,125,410. Mar. 17, 1964. Filed Aug. 27, 1959.

Two solvent extraction methods are given, the first one for extracting elements of groups IVA, VA, Sn, Y, Pa, Th, In, and the heavy rare earths, and the second one for separating group IVA elements, In, and Th from group VA elements and Pa. The first method comprises extracting the elements from an acid solution with an organic solution of 0.6 M dibutyl phosphoric acid and 0.13 M monobutyl phosphoric acid in dibutyl ether. The second method comprises carrying out the separation with an organic solution of 0.06 M dibutyl phosphoric acid in dibutyl ether. Several examples are given of each method. (D.L.C.)

16158 LIQUID-LIQUID CONTACTING APPARATUS. Donald Hebden (to United Kingdom Atomic Energy Authority). U. S. Patent 3,126,258. Mar. 24, 1964. Priority date Sept. 25, 1958, Great Britain.

A mixer-settler apparatus is designed with means for effectively mixing the liquid phases without the use of moving mechanical parts in contact with the liquids. The means comprises a pair of passageways for each mixer compartment, a plurality of jet orifices connecting each passageway with the compartment at various levels, and means for alternately decreasing and increasing the fluid pressure in the passageways so that liquid is expelled from one passageway as it is drawn into the other passageway. (D.L.C.)

ENGINEERING

General

16159 (ORNL-3555) AN EXPERIMENTAL INVESTIGATION OF INSTANTANEOUS-COLLAPSE AND CREEP-BUCKLING CHARACTERISTICS OF CYLINDRICAL SHELLS. B. L. Greenstreet and J. M. Corum (Oak Ridge National Lab., Tenn.). Mar. 1964. Contract W-7405-eng-26. 44p.

Instantaneous-collapse and creep, or time-dependent, buckling tests were conducted on nominally 8.0-in.-OD by 0.25-in.-wall and 4.0-in.-OD by 0.12-in.-wall specimens made from commercial pipe and tubing. The material for the larger specimens was type 304 stainless steel, while the smaller ones were made of both type 304 and type 347 stainless steel. The length chosen in each case was infinite from the buckling standpoint. The instantaneous-collapse test temperatures ranged from room temperature to 1200°F, and all the time-dependent collapse tests were made at 1200°F. The results show that tube out-of-roundness is a major factor in determining the collapse pressure. They also show that, under creep-collapse conditions, the critical pressure decreases rapidly with time, initially. This decrease is then followed by a leveling off, with very little change after the first few hundred hours. Although the load-carrying abilities of the 8.0-in.-OD specimens exceeded those for 4.0-in.-OD specimens of the same material for instantaneous and short-time collapse conditions, the critical pressures were about the same in the two cases for collapse after several hundred hours. The ratio of experimental values to the allowable working pressure given by the ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Unfired Pressure Vessels, ranges from about 6.0 for instantaneous buckling to about 3.4 at 3400 hr in the case of the 8.0-in.-OD tubes. For the 4.0-in.-OD type 304 stainless steel tubes, the ratio is about 4.5 for instantaneous buckling and about 3.4 for buckling after a few thousand hours. (auth)

16160 (UCRL-11200(Vol.1)) INDEX OF LRL BERKELEY MECHANICAL ENGINEERING DEPARTMENT ENGINEERING NOTES AND SPECIFICATIONS. VOLUME 1. James O. Turner (California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 1963. Contract W-7405-eng-48. 218p.

This report supersedes UCID-1800, 1962 Edition.

An index of engineering notes and specifications issued by the Mechanical Engineering Dept. of Lawrence Radiation Laboratory, is presented which covers the time period up to approximately March 15, 1963. The index is divided into two main sections. The first section lists the documents by number, with complete bibliographical information. The second index comprises two indexes, a subject index to the numbers under which documents have been grouped, and a keyword-plus-title index (keywords in title arranged alphabetically). (D.L.C.)

Applications of Nuclear Explosions

16161 (SC-4929(RR)) CONSTRUCTION OF A SEA-LEVEL, TRANSISTHMIAN CANAL USING NUCLEAR EXPLOSIVES. L. J. Vortman (Sandia Lab., Albuquerque, N. Mex.). Feb. 1964. Contract AT(29-1)-789. 77p.

This report is based: (1) on information developed in earlier high explosive experiments which determined the optimum spacing and burial depth of charges in a row to produce a channel uniformly wide and deep, and (2) on the Sedan and Danny Boy experiments, which provided data on dimensions of nuclear craters in both soil and basalt rock. This information has been combined with the 1947 route surveys of the Panama Canal Company, and estimates have been made not only of the number and yield of nuclear explosives required to excavate a Transisthmian Canal with nuclear explosives, but also of the cost of the explosives and the cost of their emplacement. Since there is an uncertainty in the correct scaling method to use, calculations have been made in which linear dimensions of the craters are scaled as both the 1/3.4-power and the fourth-root of the yield, W. The nuclear requirements were calculated both with and without considering the necessity of the long-term stability of the crater slopes. The requirements for slope stability increase total yield about 30 percent, without an appreciable change in total cost or the number of devices. Total yield is nearly three times greater for $W^{1/4}$ scaling than for $W^{1/3.4}$ scaling. Channel widths of 750, 1000, 1250, and 1500 feet were examined. Doubling the channel width reduces the cost and number of devices 20 to 30 percent, but increases the total yield required about 2½ times. A large number of nuclear device yields were assumed available. Reducing the number of available yields, decreased the cost and number of devices for nuclear excavation, but it increased the total yield considerably. For some routes, nuclear excavation can be combined with dredging through the lower elevations in soil, thus reducing the total yield and the number of devices required. The costs may be less (or nearly the same) depending on how closely the point of equal cost of mechanical and nuclear methods is approached. Depending on the route involved, the use of nuclear explosives can reduce excavation cost by as much as 90 percent and the total cost by nearly 65 percent. (auth)

16162 (UCRL-7657) ENGINEERING PROPERTIES AND APPLICATIONS OF NUCLEAR EXCAVATIONS Louis J. Circeo, Jr. (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 5, 1964. Contract W-7405-eng-48. 47p.

The use of nuclear excavation for engineering projects depends not only on the size of the excavation, but also on the properties of the material in and around the excavation. In a nuclear excavation several general zones are evident. Among these are the true and apparent crater, crater fallback and lip throwout material, ground upheaval, and the rupture and plastic zones. The properties of the material in these zones are dependent on original medium characteristics and the effects of the detonation. The hyperbolic shape of a crater lends itself to good slope stability. The problem of slope stability in soils or highly weathered rock will be more acute than in competent rock. The condition of the rupture zone, the amount of surcharge on the crater lip, and ground shock from later detonations impose additional problems to slope stability evaluation. The fallback material will obtain a certain amount of dynamic compaction as a result of the material falling from heights of several hundred feet. Further foundation stability, if necessary, can be accomplished by standard techniques. Several applications of nuclear explosives in the

highway engineering field appear feasible. These include: (1) excavation of roadway cuts; (2) aggregate production; open pit mining; (3) drainage diversion, or interception by craters; (4) landslide removal, encouragement, or stabilization. The feasibility of using large yield explosions for engineering projects has been demonstrated in the U. S. S. R. Over the last twenty years, many large-yield conventional explosives have been used for excavation, mining, and dam construction. (auth)

Facilities and Equipment

16163 (CEA-2395) CELLULES POUR EXAMEN D'ELEMENTS COMBUSTIBLES AU PLUTONIUM IRRADIES. DEUX ANS D'EXPLOITATION, MAI 1961/MAI 1963. (Cells for the Examination of Irradiated Plutonium Fuel Elements. Two Years Operation, May 1961/May 1963). A. Valentin (France. Commissariat a l'Énergie Atomique. Centre d'Etudes Nucléaires, Fontenay-aux-Roses). 1963. 106p.

Within the framework of the "Rapsodie" fast reactor program, prototype plutonium fuel elements are irradiated and then examined in an $\alpha\beta\gamma$ laboratory at Saclay. This laboratory consists of five in-line cells and a lead enclosure microscope. Each cell contains an α sealed removable box 4 ft 3 in. high, 4 ft 11 in. wide and 5 ft 1 in. deep, fitted with one or two magnetic transmission indirect manipulators. The boxes are contained in an $\beta\gamma$ shielded enclosure whose front face is constructed of cast iron panels $21\frac{2}{3}$ in. thick. Nitrogen circulating in a closed loop forms the atmosphere of the boxes. This laboratory is essentially intended for metallurgical research. The functions of the various cells are as follows: transferring and packing, cutting, density measurement and cathodic etching, storage and metallography. Work on radioactive materials began in April 1961. Operational incidents have always been of a material nature only. (auth)

16164 (ERR-AN-174) A SPECIALIZED TOROIDAL PRESSURE VESSEL. C. E. Edenfield and J. Kinsley Lowry (General Dynamics/Astronautics, San Diego, Calif.). July 31, 1962. Revised Oct. 1, 1963. 38p.

A method is developed for determining the meridional contours of a toroidal shell that will produce no hoop stress resultants in the curved portion when under internal pressure. The meridional membrane force will remain tensile. The resulting toroidal pressure vessel design may eliminate the possibility of buckling failures. Methods for finding the internal volume and surface area of such a pressure vessel are also presented. (auth)

16165 (TID-7689(p.137-42)) WEAR MEASUREMENT OF MACHINE PARTS BY ACTIVATION ANALYSIS. Henry L. Wood and Benjamin A. A. Logerquist (Virginia Polytechnic Inst., Blacksburg).

A radioactive tracer technique for measuring wear of machine parts is discussed. The technique consists of irradiating the machine element, placing it in the machine assembly, and monitoring the lubricant carrying radioactive wear particles. The technique was found to be extremely sensitive. (M.C.G.)

16166 (WCAP-2526) CONCEPTUAL DESIGN AND COST ESTIMATE FOR SODIUM PUMP TEST FACILITY. J. R. Blanchfield, Jr. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Nov. 1963. Contract AT(30-1)-3123. 124p.

This report covers the conceptual design and operation of a Sodium Pump Test Facility designed to provide a testbed for the testing of future sodium pumps under simulated operating conditions. Cost estimates of engineering, equipment, construction, operation and maintenance and schedules for design, construction and operation of the facility are included. (auth)

16167 DEUTERIUM-FILLED THYRATRON FOR HIGH-POWER SWITCHING. L. E. Algar (General Electric Co. Ltd., Wembley, Eng.), J. E. Marshall, and C. R. Russell. G.E.C. J. Sci. Tech., 31: No. 1, 37-42 (1964).

A deuterium-filled thyratron GHT6 with new design features was developed to control the very high pulsed powers required in many current developments. It handles 200 megawatts peak power and 150 kw mean, at a hold-off voltage of 40 kv and with a peak current rating of 10,000 amp. Application of the deuterium-filled thyratron to linear accelerators is briefly discussed. (P.C.H.)

16168 ZONAL CENTRIFUGE, B-II (Engineering Materials). (Oak Ridge Gaseous Diffusion Plant, Tenn. and Oak Ridge National Lab., Tenn.). (CAPE-1107)

The 26 drawings in this package are for an intermediate-speed centrifuge designated B-II. It is designed for operation at 40,000 rpm. The rotor chamber is 25.72 cm long with an ID of 10.16 cm. The rotor is driven from below by a Spinco Model L preparative ultra centrifuge drive. The fluid line connections are at the top. There are a number of rotor cores used with the B-II system. The B-IV[1], B-IV[2], B-V, B-VI, B-VII, and B-VIII rotor cores are included. The B-IV core has been used successfully to separate quantities of ribosomes and ribosomal subunits from cell extracts. This takes from $1\frac{1}{2}$ to 2 hr of centrifugation. The B-IV[2] core has an improved outlet system and is a modification of the B-IV[1] core. The B-V, VI, VII, and VIII rotor cores are prototypes for the flow-through system. The B-V and VIII cores are most frequently used. The B-V core gives the same resolution as the first B-II core but has only four septa, whereas the B-II core has 36 septa. The B-V core is effective in rate-zonal separation of large particulates from bacterial protoplasts. Drawings are included for flat-face seals using a Rulon runner and a hardened 440 stainless steel runner. The entire seal is enclosed to provide a buffer cavity for a disinfectant to inactivate any virus particles that may leak out between the seal faces. (F.S.)

16169 SELF ENGAGING COUPLINGS. Deric Birkenshaw and Ian Laird McKenzie Paterson (to Nuclear Power Plant Co. Ltd.). British Patent 952,328. Mar. 18, 1964. Filed Mar. 11, 1960.

A self-engaging coupling is described for interlocking two bodies, which under operating conditions are subjected to a resultant force due to fluid pressure that tends to separate the bodies. The coupling has displaceable members housed in the walls of a cage forming part of one body and displaceable into recesses in the other body to interlock the bodies. The arrangement is such that during an initial condition when the resultant force due to fluid pressure is substantially removed, means are provided to displace at least some of the displaceable members into their respective recesses, and during a final condition during which the resultant force due to fluid pressure is restored, means are provided for transmitting the force to the remainder or all of the displaceable members to lock them in position in their respective recesses. The means transmitting the resultant force due to fluid pressure is in the form of a cylindrical member slidable within the cage housing the displaceable members within limits imposed by a stop on the cage. (M.C.G.)

Heat Transfer and Fluid Flow

Refer also to abstracts 16441 and 17322.

16170 (EURAEC-896) DESIGN AND CONSTRUCTION OF A HIGH PRESSURE FACILITY FOR HYDRODYNAMICS EXPERIMENTS ON TWO-PHASE FLOW — INSTRUMENTATION — PRELIMINARY TESTS IN SINGLE AND TWO-PHASE FLOW. Topical Report No. 8. N. Adorni, L. Cravarolo, A. Giorgini, A. Hassid, and E. Pedrocchi (Centro Informazioni Studi Esperienze, Milan). Oct. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 060-61-7-RDI. 88p. (CISE-R-75)

The design, construction, and assembly of a facility where hydrodynamics experiments on two-phase (gas + liquid) adiabatic flow are being carried out, are described. The main characteristics of the facility, which is a closed loop, are:

Pressure	up to 25 kg/cm^2
Temperature	15 + 40°C
Test section	vertical upward
Test section length	3.5 m
Gas flow rate (at 22 kg/cm^2 pressure)	up to 1000 g/sec
Liquid-flow rate	up to 1000 g/sec

Preliminary tests both in single and two-phase flow are reported. The experiments in two-phase flow (pressure drop, film thickness, phase, and velocity distribution) were performed to check reproducibility with respect to the results obtained with the facility constructed for the CAN-1 Research Program. (auth)

16171 (EURAEC-929) HEAT TRANSFER TO STEAM–WATER MIXTURES. Topical Report No. 9. S. Bertoletti, C. Lombardi, and M. Silvestri (Centro Informazioni Studi Esperienze, Milan). Jan. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 060-61-7-RDI. 96p. (CISE-R-78)

Temperature differences obtaining between the inner surface of a heated round tube and the bulk of steam–water mixtures flowing in the tube were measured in steady state conditions and during transients. The experiments were performed with two test sections having an inner diameter of respectively 5 and 9 mm and a length/diameter ratio of 160, with uniform heat fluxes, at a pressure of 70 kg/cm^2 and for mass velocities ranging from 100 to 400 g/cm^2 sec. Tabulated data are given. Characteristic aspects of the observed phenomena are discussed. (auth)

16172 (EURAEC-951) LARGE SCALE EXPERIMENTS ON HEAT TRANSFER AND HYDRODYNAMICS WITH STEAM–WATER MIXTURES: CRITICAL HEAT FLUX AND PRESSURE DROP MEASUREMENTS IN ROUND VERTICAL TUBES AT THE PRESSURE OF 51 KG/CM^2 ABS. Topical Report No. 2. A. Alessandrini, G. Peterlongo, and R. Ravetta (Centro Informazioni Studi Experienze, Milan). Dec. 1963. Work performed under United States–Euratom Joint Research and Development Program. 64p. (CISE-R-86)

Critical heat flux and pressure drop data are presented. The measurements were made for upward flow of steam–water mixtures in round vertical tubes at the constant pressure of 51 kg/cm^2 abs. The range of variables is:

test element heated length:	80 + 240 cm
inner diameter:	1.5 + 2.5 cm
specific mass flowrate (mass velocity):	110 + 380 g/cm^{2}sec
inlet mass steam quality:	−0.2 + 0.6

The test elements are preceded by a mixer and followed by a separator. (auth)

16173 (NP-13656) ISSLEDOVANIE TEPLOOTDACHI PRI TECHENII ZHIDKIKH METALLOV V TRUBAKH. (Investigation of Heat Transfer in Liquid Metals Flowing Through Pipes). V. I. Subbotin, V. D. Talanov, P. S. Ushakov, B. N. Gabrianovich, and I. P. Sviridenko (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). [nd]. 48p.

Heat transfer in mercury flowing in stainless steel and nickel tubes and in Na–K in copper tubes was investigated at 100 < Re < 8400 and Pr ~ 0.02 to 0.03. The results were correlated with published data, and some problems of heat transfer at small Re number were analyzed. Experimental installations and methods are described. (R.V.J.)

16174 (NP-13660) OBOBSHCHENIE OPYTNYKH DANNYKH PO TEPLOOBMENU ZHIDKOGO METALLA V TRUBAKH. (Summary of Experimental Data Concerning Heat Exchange in Liquid Metals in Pipes). P. L. Kirillov (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 26p.

Experimental data and calculations on heat transfer from liquid metal to pipes were generalized. Diagrams and tables of various authors are correlated and analyzed. (R.V.J.)

16175 (NP-13712) TEPLOOBMEN PRI POPERECHNOM OBTEKANII PUCHKOV TRUB. (Heat Exchange in the Transverse Flow Around Tube Bundles). V. I. Subbotin, V. S. Minashin, and E. I. Deniskin (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 20p.

Heat exchange in transverse mercury flow around tube bundles in staggered and straight line distributions with equal spacings of $S_1/d = 1.2$ (and at $S_2/d = 1.1$ to 1.5) and Re numbers from 150 to 5000 was investigated. Temperature profiles along the wall and mean heat transfer coefficients were found. A large temperature fluctuation, which reached to 60% of the mean, was discovered in transverse flows of liquid metal and water. The fluctuation was investigated as a function of bundle geometry, flow rate, heat flux, wall material, contact thermal resistance, inflow conditions, etc. In tightly staggered bundles ($S_1/d = 1.2$ and $S_2/d = 1.1$) the temperature fluctuation was 3 to 4% and in loosely staggered and straight line bundles it was 40 to 70%. (R.V.J.)

16176 (NYO-2930-1) A STUDY OF THE MEAN-FLOW CHARACTERISTICS OF GAS-SOLID SUSPENSIONS. Technical Report No. 101-ME-F. Richard L. Peskin and Harry A. Dwyer (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Feb. 1964. Contract AT(30-1)-2930. 54p.

A study of gas mean velocity profiles and solid mean velocity profile was undertaken for a horizontal suspension of small particles suspended in turbulent air. Small pitot tubes were used to measure air velocity profiles, and small fiber optic instruments were developed for solids velocity profile measurements. An analysis was made of the effect of the solids motion on the mean gas velocity, the laminar sublayer structure, and the shear stress at the wall. An evaluation of the slip velocity of solids was made, and the contribution of the solids motion to overall dissipation was computed. The flow system was a horizontal 3 inch by 3 inch channel in which the mass flow of solids and gas were set independently and held fixed. The system is capable of flowing in excess of 15 pounds of solids per pound of air at over 100 feet per second. However, this study is restricted to flows of less than 4 pounds

of solids per pound of air. Fiber optics of 240 micron diameter were used to measure solids mass flow rate locally, and solids density was measured locally by a special light attenuation meter. Both probes were small enough to probe into high shear stress region of the flow. The effect of solids motion on the gas velocity profile could be described by dividing the usual u/V^* versus log yV^*/ν graph into four regions determined by size, spacing, and particle material density. The effect of solids on the mean gas velocity depended on whether the solids caused primarily inertial, viscous, and/or small perturbation forces in the laminar sublayer. The inertial disturbances cause a destruction of the laminar sublayer and increased wall shear stress. The viscous disturbances increased the size of the laminar sublayer and reduced shear stress. The small perturbation disturbances had no effect on wall shear stress. In the case of small perturbation effects, the dissipation due to solids motion was caused primarily by the mean slip velocity and local fluctuating velocities of the turbulent motion. The lower overall friction factor for the small perturbation regime as measured and reported in the literature can be explained with the help of this analysis. (auth)

16177 (TID-20133) HIGH ACCELERATION FIELD HEAT TRANSFER FOR AUXILIARY SPACE NUCLEAR POWER SYSTEMS. Quarterly Technical Report, September 1, 1963–November 30, 1963. H. F. Poppendiek, N. D. Greene, C. M. Sabin, R. K. Livett, and F. R. MacDonald (Geoscience Ltd., Solana Beach, Calif.). Contract AT(04-3)-409. 25p. (GLR-19)

The influence of radiation on the vaporization of liquid droplets was studied analytically. It was found that for practical conditions, the radiation term was small in comparison to heat conduction through thin vapor films. Vaporization lifetimes of mercury droplets located on a hot, horizontal surface were measured experimentally for a range of wall-saturation temperature differences. A series of different drop geometries and dynamic states was observed. Experimental vaporization lifetimes for wall-saturation temperature differences greater than about 200°F compared favorably with analytical values. A series of forced-flow boiling heat transfer experiments was conducted using Freon 11 in a Pyrex tube with a peripheral heating coil. Flow visualization studies were made and quantitative heat transfer data were obtained with this system, thus making it possible to relate flow mechanics to variations in the heat transfer conductance. Six different flow regimes were characterized with this heat transfer system. The new low pressure boiling liquid metal heat transfer system having a Haynes 25 alloy test section was fabricated and assembled; no-load heat loss measurements indicate that less than ten % of the electrical power to the boiler section is lost through the insulation. Experimental and analytical information on forced-flow, saturated boiling heat transfer is interpreted; differences in water and mercury boiling processes are indicated. (auth)

16178 (TID-20336) TWO-PHASE FLOW THROUGH APERTURES. Progress Report. Kenneth Chen (Minnesota. Univ., Minneapolis). Mar. 9, 1964. Contract AT(11-1)-926. 14p.

An aperture with a $\frac{1}{2}$-in. dia opening, tapered at 60° to a $1\frac{1}{2}$-in. dia opening, and $1\frac{21}{32}$ in. long is analyzed. The measurements include mass flow rates, pressure profiles in the aperture, and thrust measurements as functions of the initial pressure of saturated water in the vessel. The pressure remains constant along the length of the aperture and a critical pressure ratio of 0.3 is observed, independent of the upstream saturation pressure. Use of this ratio to evaluate the backpressure for the usual orifice equation leads to an accurate prediction of the mass flow rates. Thrust measurements are compared with predictions. Several models are used to estimate the quality. As yet, no model is successful in predicting in the back pressures in the aperture. (auth)

16179 (WCAP-2056(Pt.II)) HIGH-TEMPERATURE SUPERCRITICAL PRESSURE WATER LOOP. PART II. INITIAL OPERATIONAL CHARACTERISTICS. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Feb. 1964. Contract AT(30-1)-2948. 58p.

A description is given of the operational experiences during the first few months of operation of a high temperature supercritical pressure (water) loop. Initial testing was accomplished as the first part of a heat transfer and corrosion development program. A description of the loop and test section design is given in WCAP-2056, Part I. The loop operational problems have been primarily of a mechanical nature. Some minor changes have been made to the loop system to permit more rapid attainment of steady state conditions. A considerable effort was required to achieve the desired test section wall temperature accuracies. A redesign of the method of thermocouple attachment and an out-of-loop check-out procedure were developed which gave the desired accuracy and reproducibility. The system was operated at pressures up to 4000 psig, with test section bulk fluid inlet temperatures as high as 750°F, and with bulk fluid exit temperatures in the vicinity of 1000°F. Test section bulk fluid inlet conditions included sub-saturated water, supercritical fluid, and superheated steam. (auth)

16180 (AEC-tr-6364) THEORETICAL STUDIES OF HYDRODYNAMIC INSTABILITY IN A BOILING CHANNEL. A "DENSITY EFFECT" MODEL AND A "PROPAGATION" MODEL. J. Boure. Translated for Argonne National Lab., Ill., from Societe Europeenne d'Energie Atomique, Symposium of Studsvik, Sweden, October 1-3, 1963. Work Performed under United States–Euratom Joint Research and Development Program. 28p.

A uniformly heated boiling channel followed by a riser is considered. The total pressure drop between the channel inlet and riser exit is assumed to be constant. (1) The first model, the "density effect" model, is based on the variation of the fluid density with enthalpy. When trying to eliminate everything which does not directly affect the two-phase mechanism, a "single-phase model" is obtained, in which the density of a fictitious single-phase fluid is only a function of enthalpy. The results from a simulation on a PACE analog computer were found very encouraging. A further analytical study of simple cases was then made on CAB 500 for small perturbations. The model includes only three parameters which are related to friction, power and flow, and a "condition" of the instability is obtained which accounts well for the experimental observations and for the orders of magnitude. (2) The second model is based on the "delay effect" introduced by the time necessary for the propagation of a disturbance through the two-phase zone: this is the "propagation model." The dynamic equation is integrated at each moment, a fact which requires knowledge of the position, and therefore of the velocity of the disturbance. The model having given promising results, there was made a complete study of the propagation velocity of the disturbance, taking into account the mass transfer between phases and the fact that there is flow with slip. The velocities of propagation are extremely different depending on whether or not there is a mass

transfer. The velocity to be introduced into the model is a continuity wave velocity which is of the same order of magnitude as the velocity of the liquid. An experimental study of the transient conditions would be necessary to make possible greater accuracy. Studies on these two models are continuing for the purpose of quantitatively finding results comparable with the experiment and especially with those exposed during the preceding session. (auth)

16181 (AERE-Trans-997) BUBBLE MOTION IN FLUIDIZED SOLID/GAS SYSTEMS. L. Massimilla, P. Calia, and G. Volpicelli. Translated by L. Pirt (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from Chim. Ind. (Milan), 45: 23-9(1963). 12p.

The examination of high-speed film sequences taken during solid-particle fluidization experiments suggested a theoretical interpretation of bubble motion in solid-gas suspensions. The bubbles are regarded as moving by displacement of particle aggregates forming their boundary under the pressure of the gas passing through them, their behavior depending on the resistance to gas inflow and outflow by increases and decreases in particle concentration in the surrounding solid-gas system. The interaction of two or more bubbles causes a rapid transfer of gas from one to the other with formation of larger bubbles and possibly dissipation of some of the gas in them, after the collision. This treatment forms the basis for the definition of a single-cell fluidized bed traversed longitudinally by a sequence of bubbles separated by partitions of particles, forming a preferential path for the gas. The expressions for the spatial velocity in such a bed (which usually exists in laboratory fluidizations) show the physical significance of the "bypass" of a gas flow through a fluidized particle bed. (auth)

16182 (EURAEC-638) INVESTIGATION OF TWO-PHASE (AIR-WATER) FLOWS ON A SENN TYPE ASSEMBLY FRACTION WITH AND WITHOUT TWIST STRIPS. Special Report No. 8. (Société Nationale d'Étude et de Construction de Moteurs d'Aviation, Suresnes, France). Feb. 12, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-RDF-III. 106p. (A translation)

Results are reported of pressure drop and vacuum fraction measurements for a two-phase flow with and without twist strips on two 4-rod sections. (D.L.C.)

16183 (EURAEC-639) INFLUENCE OF WHORLS INDUCED IN BOILING WATER AT LOW PRESSURE ON THE CRITICAL FLOWS. Special Report No. 9. (Société Nationale d'Étude et de Construction de Moteurs d'Aviation, Suresnes, France). Jan. 30, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7-RDF. 116p. (A translation)

Tests were carried out on tubular test sections of diameter 10 mm, length 800 mm at low pressure to study the effects of whorls induced by twisted strips on the critical heat flux at various flow rates. The tests were conducted at fluxes up to 6,100 kw/m^2 and flow rates up to 2 kg/sec. Steam titer, pumping power, and boiling efficiency were also studied. The test loop and equipment are described. (D.L.C.)

16184 (EURAEC-883) RESEARCH IN THE CRITICAL HEAT FLUX (BURNOUT) IN BOILING WATER. Quarterly Progress Report No. 8, July 1, 1963–September 30, 1963. H. H. Agena and J. O. Bradfute (Maschinenfabrik Augsburg-Nurnberg A. G., Nuremberg). Work Performed under United States–Euratom Joint Research and Development Program. Contract 057-61-RDD. 11p. (A translation of MAN-Tka-09-29-63 E)

Programs were compiled for various methods to calculate the thermodynamic properties of water on the IBM 1620 digital computer. The theoretical analysis to determine the void fraction of a two-phase flow was continued. To check the procedure a program was compiled for an IBM 1620 computer. The insulation of the high-pressure loop was completed and the first test section assembled. To continue the evaluation of various test results, programs were compiled for another two methods to calculate the critical heat flux on the IBM 1620 digital computer. (auth)

16185 TEMPERATURE FIELD CALCULATION IN MANIFOLD AND VESSEL BRANCHES. W. Fratzscher and D. Oertel (Technische Universität, Dresden). Kernenergie, 7: 83-7(Feb. 1964). (In German)

Equations of heat conduction were derived for various types of pipe fittings. These equations, based on the differential equation of heat flow, were solved for specific boundary conditions and the temperature distribution was thus obtained. Three cases were considered: heat conduction along a fluid layer in the branch, heat conduction in the fluid layer and in the pipe wall, and heat conduction in a branch with a cooling medium flowing in the opposite direction. Universal curves of temperature distribution were drawn, along with a diagram that applies to a specific numerical example. (OTS)

Materials Testing

16186 (WADD-TR-61-72(Vol. XXIII)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XXIII. A METHOD FOR DETERMINING YOUNG'S MODULUS OF GRAPHITE AT ELEVATED TEMPERATURES. S. O. Johnson and R. B. Dull (National Carbon Co. Advanced Materials Lab., Lawrenceburg, Tenn.). Apr. 1963. Contract AF33(616)-6915. 20p.

A vibrational or sonic method was developed for determining the elastic modulus of graphite to temperatures of 3000°C. Theory is summarized and working equations are provided. Limitations and assumptions made are discussed with reference to other methods of measurement. Apparatus and procedure are described in detail. Some typical results are included to demonstrate feasibility of the method. (auth)

16187 STRESS-STRAIN FACILITY EQUIPMENT (Engineering Materials). (Southern Research Inst., Birmingham, Ala.). (CAPE-1103)

Seven photographs and 97 drawings of a facility to determine the stress-strain properties of brittle materials are included. Other properties of brittle materials were explored including compression, shear, Poisson's ratio, and thermal properties. Special equipment was developed for the facility, which included: a radiant heating source for raising the temperatures of specimens to 5200°F; gas-bearing universals to accomplish uniaxial loading; a tensile load frame; an optical strain analyzer with fully automatic and continuous recording; a mechanical drive system; and a load train. The heating source is a resistance element furnace with a hot zone 2 in. ID and 2½ in. long. Later modifications of the furnace included pressurization with helium, which permitted performance to temperatures of 6500°F. (F.S.)

Vacuum Engineering

16188 A HIGH VACUUM GATE VALVE FOR THE CONTROL OF FLUIDS. (to High Voltage Engineering Corp.). British Patent 952,265. Mar. 11, 1964. Priority date July 3, 1961, United States.

An all-metal, bakeable gate valve is designed for ultra-high vacuum systems operating below 10^{-6} mm Hg, such as in accelerators and isotope separators. The valve comprises a housing with two aligned apertures on its opposite walls, a gate, and gate advancing means. One aperture is surrounded by an annular knife edge, and the other aperture is surrounded by a chamber having flexible boundaries (double bellows); means are provided for introducing pressurized fluid into the chamber to press the gate into its closing position against the knife edge. (D.L.C.)

GEOLOGY AND MINERALOGY

General

16189 (AD-427125(Rev.)) CLEARWATER. Long Range Seismic Measurements of VELA UNIFORM Project 8.4. Technical Report No. 63-105. (Geotechnical Corp., Garland, Tex.). Oct. 16, 1963. Revised Feb. 5, 1964. 29p.

An analysis is made of the film seismograms made at 37 mobile field teams and 4 VELA observatories at the time of the CLEARWATER underground nuclear test (Oct. 16, 1963). The results are presented as principal phases, unified magnitudes, reduced travel times, and maximum amplitudes. (D.L.C.)

16190 (NP-13757) LOCAL SEISMIC MONITORING AT SHOAL. Technical Report No. 5. Preliminary Report. W. H. Westphal and G. S. Brink (Stanford Research Inst., Menlo Park, Calif.). Nov. 15, 1963. Contract AF49(638)-1205. 21p.

Local seismic monitoring was initiated in the Fairview Peak region of Nevada in July 1961, and was conducted at intervals until 21 October 1963, five days prior to SHOAL Event. Since that date, continuous measurements have been made at three seismograph stations located approximately 10 km northeast, 10 km southwest, and 3.4 km west of ground zero. Preliminary evaluation of data accumulated through November 11 indicates that the majority of these events had their epicenters in the Fairview Peak fault block; this was true also of the majority of recorded preshot events. (auth)

16191 (NP-13586(Rev.)) STONES. Long Range Seismic Measurements of VELA UNIFORM Project 8.4. Technical Report No. 63-126. (Geotechnical Corp., Garland, Tex.). May 22, 1963. Revised Mar. 5, 1964. 32p.

An analysis was made of the seismograms collected from the 34 mobile field teams and the observatory at the time of the STONES underground test, May 22, 1963. The results are presented as principal phases, unified magnitudes, reduced Pn and P travel times, maximum amplitudes of Pn and P, maximum amplitudes of Pg, and maximum amplitudes of Lg. (D.L.C.)

16192 (TID-7689(p.38-45)) SOME USES OF FLUID TRACERS IN OIL WELLS. R. George Mihram (Halliburton Oil Well Cementing Co., Duncan, Okla.).

Basic processes and materials for fluid tracers in oil wells are discussed. Assumptions and limitations in the use of radioactive tracers, and some possible errors involved, are outlined. Examples of uses are given. (M.C.G.)

16193 (TID-7689(p.85-6)) MECHANISM OF METHYLENE BLUE DYE ADSORPTION ON SILICEOUS MINERALS. C. S. Brooks (Shell Development Co., Houston, Tex.).

Studies were undertaken to establish the mechanism of methylene blue adsorption from aqueous solution on common siliceous minerals found in petroleum reservoir formations. These minerals were prepared so that all sites on the mineral surfaces were occupied by ^{22}Na and ^{22}Na. Measurement of the transmittance and gamma activity of the equilibrium solutions permitted a quantitative determination of dye cation adsorption and of sodium cation displacement. (M.C.G.)

16194 (TID-7689(p.105-18)) HOW TO OBTAIN MORE FRACTURING INFORMATION BY THE USE OF RADIOISOTOPES. R. George Mihram (Hilliburton Oil Well Cementing Co., Duncan, Okla.).

It is shown how radioisotopes can be used to obtain fracturing information, how this information can be applied to the solution of fracturing problems, and how results can be interpreted. The use of radioactive sand for locating the origin and determining the type of fracture is described. Fracturing procedures and fluids can be evaluated by this method. (M.C.G.)

16195 (TID-7689(p.142)) SEDIMENT GAUGE FOR RIVERS AND STREAMS. J. Papadopoulos, F. B. Sellers, C. A. Ziegler (Parametrics, Inc., Waltham, Mass.); and J. R. McHenry (Department of Agriculture. Sedimentation Lab., Oxford, Miss.).

An x-ray attenuation gage capable of providing a continuous record of sediment concentration in rivers and streams was developed. Tests were carried out at flow rates up to 6 ft/sec and with differing sediment compositions. The gage provides a value of sediment concentration integrated at 15 min intervals over the range from 1,000 to 50,000 ppm. (M.C.G.)

16196 A STUDY OF DILUTION IN THE OTTAWA RIVER USING RHODAMINE B. I. NPD TO DEEP RIVER. W. F. Merritt (Atomic Energy of Canada Ltd., Chalk River, Ont.). Health Phys., 10: 195-201(Mar. 1964).

Rhodamine B, a fluorescent dye, was used to study dilution in the Ottawa River downstream of the NPD reactor site. Dye was injected into the NPD process sewer for a 3-hr period and the concentration measured as it dispersed in the river. An initial dilution of 100 was observed near the outfall. A wide, deep section of the Ottawa River downstream of the reactor site acted as a detention and mixing basin. Dye concentrations at the town of Deep River water intake, 16 km downriver, indicated a minimum overall dilution of the effluent of 3×10^4. The water velocity in this section of the Ottawa River was about 9 km/day. (auth)

16197 A NOTE ON SURFACE WAVES FROM THE HARDHAT NUCLEAR EXPLOSION. Keiiti Aki (California Inst. of Tech., Pasadena). J. Geophys. Res., 69: 1131-4 (Mar. 15, 1964).

The records from many stations were studied in order to determine the nature and origin of the Love and Rayleigh waves that were generated by the Hardhat explosion. A check was first made on the validity of the assumption that Love and Rayleigh waves originated from a common source at the same time. The origin times of the two waves were shown to agree within the experimental error, and the assumption was not rejected. The amplitude ratio and the source phase difference between the two waves were obtained for various azimuths from the source, and they were shown to be consistent with the double couple corresponding to a vertical strike-slip fault, the strike direction being N30°W or N60°E. The observation, however, permits a superposition of an explosive source, making the contribution to the amplitude of Rayleigh waves less than half of that from the double couple. (auth)

16198 OCEAN-BOTTOM SEISMIC MEASUREMENTS OFF THE CALIFORNIA COAST. W. A. Schneider and M. M. Backus (Texas Instruments, Inc., Dallas). J. Geophys. Res., 69: 1135-43(Mar. 15, 1964).

Seismograms were recorded between December 19, 1961, and April 1, 1962, from instruments placed on the ocean

bottom off the California coast in water depths up to 1.2 km. Three components of velocity and water pressure were recorded digitally. During the test period a total of five underground nuclear blasts originating from the Nevada test site and several small unidentified seismic events were recorded by the ocean-bottom seismometer. Recordings of pressure and vertical velocity in the frequency range of 0.5 to 5 c for three nuclear blasts were of sufficient quality for detailed analysis. Spectral analyses were performed on several of these nuclear blast seismograms and the noise data immediately preceding them. These were compared with similar analyses of the same events obtained from a land station in the southern California area. The results indicated that signal-to-noise ratio is slightly poorer on the ocean bottom in 1.2 km of water than on a land station at the same range. The absolute noise level appears to be higher at the deep water sites relative to the land station; however, the ocean-bottom noise level is near the continental average of Brune and Oliver for the samples investigated. Finally, the simultaneous recording of pressure and velocity appears to afford a distinct advantage of the identification and classification of arrivals recorded on the ocean bottom because of the P-V relation that exists for the various propagation modes. (auth)

16199 THE EFFECT OF CATION-EXCHANGE CAPACITY, CLAY CONTENT, AND FIXATION ON RUBIDIUM-86 DIFFUSION IN SOIL AND KAOLINITE SYSTEMS. S. D. Evans and S. A. Barber (Purdue Univ., Lafayette, Ind.). Soil Sci. Soc. Am. Proc., 28: 53-6(Jan.-Feb. 1964).

An investigation of the factors influencing the diffusion of Rb^{86} in eight soils showed that the more strongly Rb^{86} was absorbed by the soils the slower was the rate of diffusion. In leached soils that were dried after labeling, diffusion was correlated with the amount of Rb^{86} fixed against NH_4OAc extraction. In leached soils that were kept moist after labeling, diffusion was closely related to clay content and exchange capacity. In dilute kaolinite systems, diffusion was related to the amount of Rb^{86} in solution. (auth)

16200 A COMPARISON OF Mg^{2+}, Ca^{2+}, AND Sr^{2+} AS EXCHANGE IONS FOR MINERALOGICAL STUDIES OF CLAYS. S. B. Weed and R. A. Leonard (North Carolina State Coll., Raleigh). Soil Sci. Soc. Am. Proc., 28: 58-62 (Jan.-Feb. 1964).

Strontium-, Ca^{2+}-, and Mg^{2+}-saturated clay minerals were studied with respect to x-ray diffraction, differential thermal analysis, cation exchange capacity, and glycerol adsorption. In general, 3-layer clay minerals saturated with Sr^{2+} lost interlayer water at lower temperatures and at higher vapor pressures than did Mg^{2+}-clays; Ca^{2+}-clays were intermediate. A clay mineral-ion-saturation interaction was apparent. Calcium- and Sr^{2+}-saturation of clays yielded similar values for cation exchange capacity. Strontium-saturated 3-layer clays retained more glycerol than did clays saturated with Ca^{2+}. Expansion of vermiculite with glycerol and ethylene glycol was dependent on cation saturation and lattice charge. Strontium-saturated vermiculites expanded to near 16 Å more readily than did Mg^{2+}-clays, and Ca^{2+}-clays were intermediate. Vermiculites with high lattice charge expanded less readily than did vermiculites with relatively low lattice charge. Strontium can satisfactorily substitute for Ca^{2+} and Mg^{2+} in routine mineralogical studies of clays though special care may be needed to control relative humidity. Additional information regarding lattice charge of 3-layer clays may be obtained by using several divalent ion saturations. (auth)

16201 INFLUENCE OF NEUTRON METER ACCESS TUBES ON SOIL TEMPERATURE AND WATER UNDER WINTER CONDITIONS. David D. Dickey (Dept. of Agriculture, Bozeman), Hayden Ferguson, and Paul L. Brown. Soil Sci. Soc. Am. Proc., 28: 134-5(Jan.-Feb. 1964).

A study was designed to investigate the influence of neutron meter access tubes on soil temperatures and water movement under rigorous winter conditions. A 6-ft steel neutron meter access tube was placed in each of two plots in a young alfalfa field, consisting of Amsterdam clay loam. Copper thermocouples at various distances from the tube were placed at various depths below the surface. Weekly temperature readings indicated that the access tubes had little influence on the soil temperature. Slightly higher but statistically insignificant water content values were observed near the tube. (H.M.G.)

Natural Radioactivity and Fallout

Refer also to abstracts 15735, 15758 and 16243.

16202 (AD-416645) APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 21, March 1, 1963–May 31, 1963. Pauline M. Austin (Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology). June 15, 1963. Contract DA 36-039; SC-75030. 8p.

Radar observations were taken on 20 days during the quarter, but only a few storms contained significant amounts of precipitation since New England suffered a severe drought. The RHI on the SCR-615-B is ready for taking observations in summer convective storms. The automatic sweep, quantized level display, and camera and stovepipe assembly are all in operation. Auxiliary circuits for the F-M sweep integrator are nearly complete, and satisfactory progress was made on the storage tube data processor. Processing of the signal intensity contours and analysis was continued on all phases of the numerical survey of storm structure, with special attention directed toward bringing the synoptic classification of the storms up to date. Computations were completed for the dispersion of radioactive debris from a 10 KT surface burst in a series of model wind fields. Those for a 1 MT detonation are in progress. (auth)

16203 (NYO-10496) HIGH-ALTITUDE BALLOON SAMPLING PROGRAM. Quarterly Report No. 1. Fernando Bazan and Herbert Feely (Isotopes, Inc., Westwood, N. J.). Feb. 1, 1964. Contract AT(30-1)-3276. 54p.

A study was made of the results of radiochemical analysis of balloon-collected filter samples. Only a small fraction of the debris from either the 1961 or 1962 Soviet test series was found to have entered the Southern Hemisphere by the middle of 1963. Very little of the debris from the 1961 Soviet test series stabilized in the stratospheric layers above 70 or 75 kft. Significant quantities of debris from the 1962 Soviet tests did stabilize in the upper polar stratosphere of the Northern Hemisphere, and this debris showed no tendency fall out rapidly during 1963. Some debris from the 1962 U. S. tests reached San Angelo by June 1963 and Mildura by August 1962. Most of this debris was derived from the low altitude bursts at Christmas Island. Debris from the high altitude rocket shot Starfish Prime, indicated by the tracer nuclide ^{109}Cd,

was encountered at Mildura at 105 kft in December 1962 and in succeeding months, and at San Angelo at 100 kft or higher in March 1963 in low concentrations and in July 1963 in higher concentrations. The $^{109}Cd/^{90}Sr$ ratio in this debris was so low as to suggest that the ^{109}Cd yield of Starfish Prime may have been 0.055 MC or lower. Probably no debris from the 1961 Soviet tests accompanied the debris from Starfish Prime which reached Mildura, though the available data allowed an upper limit of about 31% to be put on the contribution from this source. These data did show, however, that if Soviet debris was encountered with the Starfish Prime debris at Mildura it was not derived from the Soviet tests that produced large quantities of products of neutron activation in 1961. The available data can be interpreted to indicate that virtually all of the debris from Starfish Prime that was present in the Southern Hemisphere in mid-1963 had already moved into the stratospheric layers below 100 km. (auth)

16204 (SCPRI(RM)-XII-1963) RAPPORT D'ACTIVITE, DECEMBRE 1963. (Report of Activities, December 1963). (France. Service Central de Protection contre les Rayonnements Ionisants, Paris). 22p.

The results of measurements of the activities in rainwater, the atmosphere, milk, vegetation, ocean water, soil, animals, and water supplies are tabulated. The activities at and from nuclear stations are covered. Changes from previous determinations are noted. (D.C.W.)

16205 (TID-20369) SURVEY OF ENVIRONMENTAL RADIOACTIVITY. Report No. 1. (Ames Lab., Ames, Iowa). Dec. 31, 1963. Contract [W-7405-eng-82]. 29p.

Gross β and α radioactivity determinations were made of air samples, soil, vegetation, well water, river water, and river bottom sediments during 1962 and 1963. The measurements were made to determine environmental radioactivity prior to the operation of the Ames Laboratory Research Reactor. (C.H.)

16206 (USNRDL-TR-662) SOIL-MOISTURE PREDICTION METHOD FOR NRDL INDUCED-ACTIVITY PREDICTION SYSTEM. E. Laumets (Naval Radiological Defense Lab., San Francisco). July 17, 1963. 54p. (AD-416807)

Part of the military problem of predicting the gamma-radiation doses at 3 feet above the ground produced by the radioactivity induced in soil elements by neutrons emitted from nuclear air bursts is that of predicting the moisture content in the top soil layer of interest. The greater the moisture content in this layer, the closer to the surface lies the major part of the thermal neutron flux, since hydrogen atoms in the water are highly effective in thermalizing neutrons. Thus, there is less attenuation of the resulting gamma radiation by the soil. A method of predicting the soil moisture content in the top 6 inches of soil is described. The method, whose computational procedure follows a simplified "bookkeeping" form, is based on soil textures and experimental values on daily moisture accretion and depletion for different seasons of the year. The method is applicable to both free and impeded drainage conditions. The method is demonstrated by simple and complex examples. (auth)

16207 RESEARCH BY THE UNITED STATES GEOLOGICAL SURVEY RELATED TO THE MOVEMENT OF RADIONUCLIDES IN THE EARTH ENVIRONMENT. Alfred Clebsch, Jr., and Alan E. Peckham (Geological Survey, Washington, D. C.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 189-97(1963).

Geologic and hydrologic research by the U. S. Geological Survey related to the movement or retention of radionuclides embraces several scientific disciplines, a wide variety of geohydrologic terranes, and various types of radioactive materials. Field studies have been completed or are in progress at all the major nuclear energy installations in the United States where large releases of radioactivity have been made, either in the form of radioactive wastes or as the consequence of nuclear explosions. Much of this work is designed to develop an understanding of the influences of geologic and hydrologic features on radionuclide movement. Chemical studies include supporting services for field projects as well as research on reactions between radioactive substances and earth materials. Descriptive geochemical research on the distribution of stable elements, such as strontium, and naturally occurring radioactive elements, such as radium and uranium, has been a small but important part of the work. Theoretical and laboratory investigation of the basic mechanisms of fluid movement as they affect the transport and dispersion of radionuclides has emphasized the effects of the abundant departures in nature from idealized systems. Work related to the development of new techniques for disposal of wastes, such as deep-well injection, ultimate storage of fluids in cavities mined in rocks of low permeability, and storage of solids or fluids in salt, ranges from the compilation of broad summaries of the geology of geologic basins to detailed geologic and hydrologic investigations at the particular site. 111 references are included. (P.C.H.)

16208 PHYSICO-CHEMICAL REACTIONS IN THE UNDERGROUND MOVEMENT OF RADIOISOTOPES. G. Gailledreau (Centre d'Etudes Nucleaires, Saclay, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 269-75(1963). (In French)

The physico-chemical state of the radioelements moving underground can influence considerably their migration velocity. In the case of ^{90}Sr, held on by monmorillonites, apatites, and activated aluminum oxide, the occurrence of electronegative colloids, selectively sorbing ^{90}Sr results in an immediate break-through of this isotope. This phenomena was demonstrated in the case of the calcite phosphate reaction. A high pH is generally favorable to ^{90}Sr sorption (apatite, aluminum oxide). The occurrence of Ca^{2+} ions acts very unfavorably on ^{90}Sr sorption by minerals specific of this isotope (apatite, aluminum oxide). The same thing occurs with organic matters; ^{137}Cs sorption, attributed to illitic clays, is not very sensitive to the nature of the solution. ^{106}Ru seems to move underground chiefly as a nitrosyl-ruthenium hydroxide complex. This complex would be weakly sorbed on soil colloids by London—Van der Waals forces. (auth)

16209 NEUTRON RADIATION OF NATURAL FORMATIONS. G. V. Gorshkov and O. S. TsVetkov. Khim. Zemnoi Kory, Akad. Nauk SSSR, Tr. Geokhim. Konf., 1: 409-23(1963).

Neutron radiation was registered with a slow neutron scintillation counter. Lower limit of sensitivity of the setup for a slow neutron flux was 0.00002 neutron/sec·cm^2, and for fast neutrons in the equivalent spectrum Po_{alpha} + Pe source 0.05 neutron/sec·4pi. Possible systematic error of the measurements did not exceed 10–15%. A total of 23 samples of minerals and rocks and a sample of metallic uranium were studied. Measurements were conducted both under laboratory conditions and in the natural deposit. To exclude the influence of cosmic radiation, the measurements for the minerals and ores were conducted at a depth of 200 meters of water equivalent underground. The formation of

neutrons in natural objects under the action of four basic factors was studied in detail: (alpha,n) reaction, spontaneous fission of heavy nuclei, neutron induced fission of U^{235}, and formation of neutrons from cosmic radiation. The accumulation of certain nuclear transformation products in natural formations was quantitatively estimated. The dependence of the neutron yield according to the (alpha,n) reaction on the weight and chemical composition of the sources was studied. The relative contribution of neutrons by certain elements contained in rocks and minerals was estimated. For example, for graphite, shale, and glauconite the greatest contribution to the observed neutron yield is given by: Al ≃ 35, Si ≃ 20, O_2 ≃ 15, Na ≃ 7, Mg ≃ 4%. It was calculated that the total number of neutrons emitted in the whole Earth's crust on account of spontaneous fission of U and (alpha,n) processes is $(1-8)\cdot 10^{18}$ neutrons/sec. (Referationyy zurnal, khimiya, No. 22, 1963)

16210 METEORITIC TRITIUM AND DIFFUSION IN α- AND γ-IRON. David Tilles (Harvard College Observatory, Cambridge, Mass.). Nature, 201: 808-9(Feb. 22, 1964).

It is pointed out that differences in hydrogen diffusion from alpha and gamma iron can account for an apparent initial rapid loss of tritium from meteorites followed by an approximately constant concentration (with tritium decaying with normal half life) over decades. He^3/He^4 ratios in meteorites are also discussed. (P.C.H.)

16211 RADIUM-226 CONTENT OF NATURAL WATERS AND COAL IN NEW SOUTH WALES. E. T. Pallister and J. H. Green (Univ. of New South Wales, Kensington, Australia). Nature, 201: 813-14(Feb. 22, 1964).

Bulk samples of surface water and coal were collected and concentrated. The solution obtained from preliminary treatment of the coal and an aliquot of the evaporated water sample were analyzed by the method of Goldin. An argon gas flow proportional counter was used. Radium contents of 36 samples of untreated surface water in New South Wales and Queensland and results of coal fraction analyses are presented in tabular form. The highest activity found in surface waters was about one-sixteenth of the maximum permissible dose established by ICRP. At present the only conclusions to be drawn from coal analyses is that there is a tendency for Ra^{226} to be associated with minerals in coal seams. (H.M.G.)

16212 RADIATION IN OUR ENVIRONMENT. Charles L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.). World Med. J., 10: 200-3(July 1963).

Estimates are given of the relation of natural and medical plus fallout radiation to the expected genetic and somatic effects in future populations. Natural radioactivity contributes a dose of roughly 0.1 rad/yr to the organs of the body, and man evolved with this burden and prospered. A consideration is made of how much radiation exposure the peoples of the earth are receiving today and from what sources, based on the UNSCEAR 1962 report. (BBB)

16213 MOTION OF FISSION FRAGMENTS FROM HIGH ALTITUDE NUCLEAR EXPLOSIONS. Stephan Ormonde and George E. Crane (Lockheed Missiles and Space Co., Palo Alto, Calif.). p.163-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The motion of debris from an atmospheric nuclear explosion depends on elastic, charge exchange, and ionizing collisions and is complicated by the presence of neutral and ionized fission fragments and their beta decays. A stochastic model was used to study this motion and the mechanics of electron injection into the earth's geomagnetic field by the delayed decays of the fragments. (auth)

16214 BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY, NO. 33, APRIL–JUNE, 1963. Tokyo, The Japan Meteorological Agency, 1963. 104p. (In English and Japanese)

Data are presented on the radioactivity in samples of airborne dusts, rain water, and sea water collected at various locations throughout Japan during April, May, and June 1963. Data are summarized on the deposition of Sr^{89} and Sr^{90} at selected locations from 1957 to 1961. (C.H.)

Techniques and Equipment

16215 DEVICE DESIGNED TO STUDY RADIOISOTOPE RETENTION BY SOFT EARTH MATERIAL, ACCORDING TO THE PERMEABILITY. A. Barbreau (Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 117-21(1963). (In French)

A device designed for performing previous permeability measurements on samples of soft earth materials, such as sands, is described. Afterwards the sand is examined for its ability to retain radioisotopes. The apparatus involves a plexiglas cylinder into which the sample is placed, and a permeabilitymeter. The two pieces are put in connection. After the permeability measurements, the head of connections are removed, and the apparatus works in active. The retention capacity is examined, then the sample is removed, divided into sections and autoradiographed. (auth)

16216 STUDY OF RADIOELEMENT MIGRATION IN THE "IN-PLACE" SOILS. P. Bovard and A. Grauby (Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 123-9(1963). (In French)

The problems of medium protection against radioactive contamination hazards led to a study on the behavior of ions in soils. A simple direct method was developed for study of in place soils contamination. However, a principal drawback remains, the necessity to extrapolate from one or two reduced size samples, to a more or less large area. This is all the problem of sampling, which is not specific of the method. However, a choice justified by classical pedological data, allowed a sufficient number of results and a suitable accuracy to be obtained. (P.C.H.)

16217 RADIOELEMENT INFILTRATION FORECAST, AT THE BOUNDARY OF PLOUGHED LAYER IN AGRICULTURAL SOILS. G. Barbier (Ministere de l'Agriculture, Versailles, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 145-50 (1963). (In French)

Experimental results on the sorption of radioelements by different cultures, during successive periods in relation with the behavior of radioelements in soils, are reported. Concerning Sr, of which exchange with Ca follows a simple law with a repartition constant settled in laboratory, the infiltrated part of ^{90}Sr can be calculated if the part of calcium is known. Data were collected from lysimetrical researches performed in the whole world about quantities of calcium yearly leached and reference to the exchangeable calcium of the considerated layer. The ratio of ^{90}Sr infiltrated every year depends essentially on the ratio between the quantity of leached salts and the exchangeable calcium in the soil. If in a clay soil with strong exchange capacity, the ratio $^{90}Sr/Ca$ is first much smaller than in

sandy soils, it is not certain it will be the same after a few ten years. Concerning ^{137}Cs, much more was retained in soils than Ca. The part eliminated every year by infiltration appears to be negligible in relation to the decay coefficient. (P.C.H.)

16218 GEOLOGIC AGE DETERMINATION BY DIRECT LEAD ISOTOPE ANALYSIS. Fredric D. Leipziger and William J. Croft (Sperry Rand Research Center, Sudbury, Mass.). Geochim. Cosmochim. Acta, 28: 268-9(Feb. 1964).

A commercial spark source mass spectrograph was used for the examination of lead isotope ratios in uranium bearing minerals. The ratio Pb^{206}/Pb^{207} was evaluated and related to geologic age. Results of some of the measurements are tabulated and compared with some of the accepted values from the literature. Advantages and disadvantages of the method are discussed. (P.C.H.)

16219 ABSOLYUTNAYA GEOKHRONOLOGIYA CHETVERERTICHNOGO PERIODA. (Absolute Geochronology of the Quaternary Period). I. K. Ivanov, N. V. Kind, and V. V. Cherdyntsev, eds. Moscow, Publishing House of the Academy of Sciences, 1963. 160p.

Age estimation techniques for determining the absolute geochronology of the quaternary period are discussed. Problems in determining the age of young formations; determining absolute age of quaternary sediments by radiocarbon; radiocarbon dating in archeology, zoology, and botany; radiocarbon method for determining chronology of upper quaternary sediments; application of activation analysis for argon age estimation; determination of absolute time scale by marine sediments; ionium, protactinium–ionium, and beryllium–silicon methods for dating marine sediments; and chemical problems and accuracy of radiocarbon dating are considered. Twenty-three papers are presented. (C.E.S.)

Thorium and Uranium Minerals

16220 THE EFFECT OF NUCLEAR FALL-OUT ON RADIOMETRIC FIELD-MEASUREMENTS IN PROSPECTING RADIOACTIVE RAW MATERIALS. Lubor Ostřihanský (Charles Univ., Prague) and Jaroslav Panenka. Jaderná Energie, 10: 35-9(1964). (In Czech)

The field instruments used in prospecting for radioactive raw materials indicated distinct activity increase of the earth surface if covered with grass, needles, or fallen leaves. Beta activity of the intensity of 15 to 30 μr/h predominated in this radiation. On the basis of the beta decay measurements in grass specimens and of the gamma spectrum of grass ash it was found that nuclear fallout was the cause of this activity. (auth)

16221 OSNOVIYE CHERTY GEOKHIMII URANA. (Principal Characteristics of Uranium Geochemistry). A. P. Vinogradov, ed. Moscow, Publishing House of the Academy of Sciences, 1963. 352p.

The geochemical properties of uranium are discussed. Topics include the crystal chemistry of uranium minerals; the geochemistry of uranium in magmatic, pegmatic, and metasomatic processes; the behavior of uranium in processes of deposit formation; uranium in sedimentary rocks; and uranium in natural waters. (C.E.S.)

16222 VOPROSY PRIKLADNOI RADIOGEOLOGII. (Problems in Applied Radiogeology). D. Ya. Surazhskii. Moscow, Gosatomizdat, 1963. 278p.

Material on the geology of uranium deposits, the mineralogy of uranium, and the geochemistry of uranium is presented. (C.E.S.)

HEALTH AND SAFETY

Refer also to abstracts 15735, 15940, 15944, 16364 and 16365.

16223 (JAERI-5012) ACTIVITIES IN THE DIVISION OF HEALTH PHYSICS IN JAERI. [Period Covered: April 1962–March 1963]. (Japan Atomic Energy Research Inst., Tokyo). 177p.

In English and Japanese.

Research activities in the field of health physics from April, 1962 to March, 1963 are reported. Power-up tests of JRR-2, criticality studies of JRR-3, operation of TCA (a light-water critical assembly), radioisotope production, establishment of 5.5-Mev Van de Graaff Accelerator, preparation for criticality of JPDR, radiation protection activities, radiation monitoring activities, internal and external exposure studies, development of decontamination techniques, and meteorological and oceanographical surveys are discussed. (M.C.G.)

16224 (LAMS-3034(p.180-3)) CESIUM^{137} BODY BURDENS OF CONTROL SUBJECTS. E. C. Anderson and A. E. Hargett (Los Alamos Scientific Lab., N. Mex.).

The ^{137}Cs content of a number of residents of New Mexico was determined by whole-body counting. Data are presented for 1962 and through May 1963. (C.H.)

16225 (MND-M-1856) SPENT FUEL SHIPPING CASK FOR PM-1 AND PM-3A NUCLEAR POWER PLANTS HAZARDS SUMMARY EVALUATION. W. P. Haass, ed. (Martin Co. Nuclear Div., Baltimore). May 1961. Contract [AT(30-1)-2345]. 108p.

The design of the spent fuel shipping cask proposed for use in transporting irradiated cores from both the PM-1 and PM-3A Nuclear Power Plants has been evaluated under normal and accident conditions. Specifically, the following aspects of the design were analyzed and evaluated: (1) The lead shielding provided within the walls of the shipping cask and associated attachments assures that ICC regulations of 200 mr/hr at the surface and 10 mr/hr at one meter distance are satisfied. (2) A rugged crash frame, cask shroud, and shipping pallet combination completely envelopes the cask and insures the structural integrity of the cask under all conditions of transport. (3) The fuel bundles, control rods, and poison plates are securely locked within the core shroud by means of a core handling fixture with suitable safety devices to guarantee no possible change in core geometry. (4) Based on an unirradiated core, adequate poisoning in the form of control rods and poison plates is provided to obtain a K_{eff} of less than 0.9 during shipment. (5) As a result of conservative calculations, sufficient heat transfer capability has been provided in the shipping cask to dissipate 2 kw of heat with coolant temperatures less than 192°F and cask surface temperatures less than 180°F with water coolant present. (6) Under loss of coolant conditions with only air as a heat transfer medium, it is shown that the peak fuel temperature is 732°F which is 218°F below the temperature at which sound fuel elements would rupture. (7) In the event of the remote accident condition in which 5% of the fuel elements are postulated to break into one foot long sections, it is shown that negligible quantities of activity are released to the surrounding environment. As a result of the foregoing conclusions, the proposed spent fuel shipping cask design is adequate for use in transporting spent cores from both the PM-1 and PM-3A plants to the Idaho Chemical Processing Plant with no undue hazard to the health and safety of operating personnel and the general public. (auth)

16226 (NP-13687) INVESTIGATION OF THE DIFFUSION OF THE GASEOUS WASTE DISPERSED FROM STACKS IN TOKAI-MURA. (Japan Atomic Power Co., Tokyo). July 1963. 53p.

In Japanese.

Various investigations have been conducted from May 1958 through June 1959 in an attempt to obtain information on the diffusion of gaseous waste given off continuously from stacks in Tokai-mura. In addition to general meteorological observations on the ground, some observations using a captive balloon, rawin-sondes, and pilot balloons have been carried out in order to survey the atmospheric condition at high altitude. Climatological observations on many items including inversion layer in the atmosphere and the flow pattern of the air current over Tokai-mura area, which affect the waste diffusion, have also been carried out extensively. The concentration of the smoke, which is generated from lead iodide and dispersed from a 65m high stack in JAERI, was measured with monitors placed throughout the area around Tokai-mura, Mito, Hitachi. Conclusions obtained from this experiment are as follows: (1) When the smoke is dispersed at the rate of 1 unit/min, monthly average concentration on the ground shows a max of 1.4×10^{-6} unit/m^3 in June and July, in the direction of south-west of Tokai-mura, in the distance of $1.0 \sim 1.5$ km. The concentration is higher than 10^{-6} unit/m^3 in Jan., Apr., Aug., and Dec. besides June and July, between SE and W of Tokai-mura, between 500m and 1.5 km. (2) Average concentration for the year is comparatively high between SE and SW, having its max of 6×10^{-6} unit/m^3 at 1 km. These conclusions were compared with the results obtained by calculation on semi-empirical formulae both of British weather bureau and of Sutton, and showed a good agreement. (auth)

16227 (NP-13691) LEAD FOR RADIATION SHIELDING. NO. 2. THE DESIGN AND CONSTRUCTION OF LEAD SHIELDED CONTAINERS. (Lead Development Assn., London). July 1963. 18p.

Notes on the design and construction of lead-shielded containers are presented for the guidance of designers. Emphasis is on the combination of the properties of the metal, good design, and correct manufacturing technique to provide an efficient shield at reasonable cost. (D.L.C.)

16228 (NP-13740) STUDY OF PROCESSES FOR THE PRODUCTION OF POTABLE WATER FROM AQUEOUS WASTES DEVELOPED IN A SHELTER. (Badger (W. L.) Associates, Inc., Ann Arbor, Mich.). Oct. 1962. Contract OCD-OS-62-120. 112p.

An adequate supply of potable water is an essential requirement in a fallout shelter. This study has evaluated many known means of converting aqueous shelter wastes into potable water. A comparison of various processes led to the selection of the three most feasible systems with a system of pre- and post-treatment and testing common to all. The processes selected as most likely to produce acceptable potable water are: (1) vapor compression distillation, (2) ion exchange and charcoal adsorption, and (3) electrodialysis. Preliminary specifications of equipment, utilities consumed, and estimated costs are given for each process. Water from the air, extracted by an air conditioning system, is discussed and recommendations made.

Recovery systems are contrasted to the normal means of water supply and it is recommended that the conventional means of supply should ordinarily be used. Recommendations are made for future research and development work. A bibliography covering the literature studied, charts, and process flow diagrams are included. (auth)

16229 (NP-13760) DATA FROM RADIATION PROTECTION PROGRAMS. Volume 2, Number 2. (Canada. Dept. of National Health and Welfare. Radiation Protection Div., Ottawa). Feb. 1964. 45p.

Data are presented from programs on fallout monitoring, reactor environment monitoring, personnel dosimetry (film monitoring), isotope safety assessments, and field investigations of radiation safety. (P.C.H.)

16230 (TID-7688(p.68-74)) EVALUATION OF CHARCOAL AND OTHER ADSORBENTS FOR REMOVING RADIOIODINE FROM HOT OFF-GAS SYSTEMS. W. Cox (Oak Ridge National Lab., Tenn.).

A four-stage charcoal column installed in the ORNL Isotopes Center hot off-gas system, was used to study the efficiency of I^{131} removal. The column showed an average total efficiency of 98.9% and an average individual stage efficiency of 75%. The particulate size of the iodine was determined to be in the range of 60 to 100 A. The iodine adsorption characteristics of several types of charcoal and of Berl saddles coated with silver nitrate were studied. The effects of sample line, temperature, and very low I^{131} concentration on the adsorption were also studied. (D.L.C.)

16231 (TID-7689(p.76-80)) USING GAMMA TRANSMISSION TO DETERMINE THE SHIELDING EFFECTIVENESS OF SPACE VEHICLES. A. D. Krumbein and P. S. Mittelman (United Nuclear Corp. Development Div., White Plains, N. Y.).

A method for determining the radiation protection offered by a space vehicle prior to its use by gamma transmission is described. The experimental configuration consisted of a gamma source, an NaI(Tl) crystal detector, and a single-channel pulse height analyzer and scaler, and it is automated. (M.C.G.)

16232 (TID-18603) CESIUM-137 BURDENS IN A DEFINED POPULATION SAMPLE. George R. Meneely, Robert M. Heyssel, Raymond L. Weiland, Howard L. Rolf, Con O. T. Ball, John L. Ferguson, A. Ross Lorimer, C. Constantinides, and E. U. Meneely (Vanderbilt Univ., Nashville. School of Medicine). [1962]. Contract AT (40-1)-2401. 19p.

To assess the variations in Cs^{137} burdens in the population of Nashville, Tennessee attributable to age, sex, race, individual and environmental differences, a subsample was randomly selected from a geographic and socio-economic stratified sample of occupied dwellings in 1959. One respondent, usually the mother, was interviewed in each household selected. Information obtained during the interview included length of residence in the area, occupation, age, sex, race, education, illnesses and operations, and daily milk contumption of household members. Appointments for measurements at the Vanderbilt Low Level Counting Facility were made for each member of the household over seven years of age. The Vanderbilt University Whole Body Counter is described, and equations are presented for calibration and whole-body burden calculations of cesium and potassium. There was good agreement in age and sex distributions of both races between a survey made in 1959 and 1960 census. Negroes of both sexes had significantly higher body potassium than whites. The median cesium burden was significantly higher in the white race, white and Negro males having a higher burden than females. Cesium burdens were found to be related to occupation of the principal wage earner, even though no association between occupation and reported daily milk consumption was apparent. However, the reported consumption of milk was not associated with the magnitude of the cesium burden in either race. It is concluded that any effort to relate radiation effects to isotope burdens must take into account individual variations related to race, sex, age, and socio-economic factors, as well as geographic and climatic influences. The studies further indicate that averaging the burden for the population as a whole may be misleading even in a restricted geographical setting. (H.M.G.)

16233 (TID-20368) FEED MATERIALS PRODUCTION CENTER ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT FOR SECOND HALF OF 1963 AND ANNUAL REPORT FOR 1963. (National Lead Co. of Ohio, Cincinnati). Jan. 20, 1964. Contract AT(30-1)-1156. 14p.

The environmental monitoring program for the sampling of air and water in the vicinity of the Feed Materials Production Center, Fernald, Ohio, is presented. The amount of material released to the environment during 1963 was small in comparison to the maximum permissible levels. (auth)

16234 (USNRDL-TR-715) FRACTIONATION. IV. ILLUSTRATIVE CALCULATIONS OF THE EFFECT OF RADIONUCLIDE FRACTIONATION ON EXPOSURE-DOSE RATE FROM LOCAL FALLOUT. E. C. Freiling, M. A. Kay, and J. V. Sanderson (Naval Radiological Defense Lab., San Francisco). Jan. 6, 1964. 34p. (AD-431227)

This report illustrates a proposed definition of surface density of contamination for the deposit of fractionated fallout. The illustrations employed give estimates of the dependence of exposure-dose rate on the degree of radionuclide fractionation and of the sensitivity of this dependence to independent fission yield input data, total yield of the device, and time of exposure. (auth)

16235 (AEC-tr-6365) DERIVATION OF THE GRAPHS FOR THE DETERMINATION OF THE PLUME RISE. F. H. Schmidt (Netherlands. Koninklijk Nederlandsch Meteorologisch Institut, De Bilt). Translated for Univ. of California, Lawrence Radiation Lab., Berkeley. Nov. 18,1963. 15p.

It is assumed that the discharge velocity of a hot plume from the outlet of a stack is caused entirely by the temperature of the gases, which is expressed in terms of potential temperature. The calculation of the plume rise is considered for adiabatic and stable atmospheres, and graphs are presented. The calculation of the maximum ground concentration from the plume rise is considered. (D.L.C.)

16236 REALISTIC AIR SAMPLING OF BERYLLIUM PRODUCTION FACILITIES. H. M. Donaldson, R. A. Hiser, and C. W. Schwenzfeier (Brush Beryllium Co., Elmore, Ohio). Am. Ind. Hyg. Assoc. J., 25: 69-76 (Jan.-Feb. 1964).

Many tests made in Be-handling facilities using the newer two-stage samplers which separate the sample into approximately the respirable and nonrespirable fractions are described. This study indicates that the very conservative threshold limit value for Be can be attained practically when one attempts to keep only the respirable fraction of Be below the recognized safe concentrations. (auth)

16237 NUTRITIONAL QUALITY OF SURVIVAL BISCUITS AND CRACKERS. John B. Longenecker and Herbert

P. Sarett (Mead Johnson and Co., Evansville, Ind.). Am. J. Clin. Nutr., 13: 291-6(Nov. 1963).

Survival rations were fed to weanling (50-g) and young (250-g) adult rats to assess their nutritional values, since these foods are designed to provide the sole diet for man for periods of two weeks or more. Weanling rats fed survival biscuits and crackers alone lost approximately 20% of their initial body weight, even when these diets were supplemented with complete vitamin and mineral mixtures. In contrast, the animals fed the low (8%) protein control diets gained 76 and 54 g, respectively, whereas the animals fed the 18% casein protein control diet gained 131 g. Low hemoglobin and plasma protein values, and the elevated liver fat levels were found in groups fed survival rations, an additional indication of their poor nutritional quality. Young adult rats receiving the survival rations alone or supplemented with vitamins and minerals lost 25 to 31 g during the 4-week period, approximately 10 to 12% of their starting weight. In contrast, the adult rats receiving the low-protein control diets gained 24 and 34 g, respectively, and those receiving the normal protein control diet gained 67 g. Liver fat levels were only slightly higher in the groups receiving the survival rations than in those receiving the control diets. No marked differences were noted in hemoglobin or plasma protein. The amino acid composition of the survival biscuits and crackers was determined by chromatographic analysis, and this composition and that calculated from data in the literature on the ingredients used in the preparation of these products are compared. Lysine was found to be only a third of the calculated value; thus, significant destruction of lysine probably occurred during baking, accounting to a great extent for the unexpectedly poor nutritional quality of these products. The other essential amino acids were found to be present at the calculated levels, except for the sulfur amino acids and isoleucine, which were decreased by 20 to 30%. Addition of lysine at 0.2% to the rations permitted moderate weight gains and gave protein efficiencies approximating those expected for the original ingredients. Thus, the unexpectedly poor quality of the survival rations is primarily due to their low lysine content. Hence, the ingredients of the survival biscuits and crackers provide a marginal level of lysine, about 3 g/100 g protein; ~$^2/_3$ of this was apparently destroyed in baking, leaving only about 1 g lysine/100 g protein in the final products. Thus, the use of these rations as the sole diet for young children, even for short periods of time, would probably result in marked weight loss. If fallout shelters are to be stocked with these survival rations, modifications of the baking conditions should be investigated in an attempt to minimize the destruction of lysine. If this cannot be accomplished satisfactorily, supplementation with other foods supplying protein of good quality is necessary. (BBB)

16238 PROBLEMS OF STORING, PACKING, AND TRANSPORTING IRRADIATED FUEL ELEMENTS. F. R. Marcus ([European Co. for Chemical Processing of Irradiated Fuels], Mol, Belg.) At. Strom., 10: 11-13(Feb. 1964). (In German)

Fuel element handling, storage, and shipping after removal from a reactor are discussed. Reasons for storage under water are listed. Regulations for transport and for the construction of containers for transport are outlined. Economics of containers and transport are discussed. Storage in Eurochemic reprocessing installations is described. (M.C.G.)

16239 MOVEMENT OF STRONTIUM AND CAESIUM IN SOILS AND ITS SIGNIFICANCE IN STUDIES ON THE CONTAMINATION OF FOOD CHAINS. R. Scott Russell and Michael G. T. Shone (Agricultural Research Council, United Kingdom). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 151-9(1963).

Experimental results are given of a long term study on the migration and fixation of strontium and cesium in several types of soil. The investigations were designed to approximate to field conditions in which the soil remained undisturbed by cultivation. The effects of the addition of nutrients and of a permanent crop of ryegrass grown on the artificially contaminated soils were also examined. The relevance of processes of migration and fixation to assessments of the uptake of strontium and cesium by crop plants is considered in the light of field experiments. (auth)

16240 WORKING CONDITIONS AND RADIATION LEVELS AT MINES BEING EXPLOITED BY THE NATIONAL NUCLEAR ENERGY COMMISSION AND AT THE PILOT PLANT. J. Halvas, J. Telich, and R. Gonzalez C. Com. Nucl. Energia Nucl. (Mex.), [Publ.], No. 157, 117-36 (Jan. 1964). (In English and Spanish)

Working conditions of personnel at two mines that are being exploited by the National Nuclear Energy Commission and that are located, one, in the Municipality of Nazas, State of Durango and, the other, in Sierra de Gómez, State of Chihuahua are presented. The topography and natural conditions of the area are described. Mention is made of provisions taken to avoid Rn accumulation in the mines. Gamma radiation levels in the mines as well as in the places where mined material is stored are established. Measurements of amount of atmospheric dust in the mines are given and an analysis thereof is attempted. The medical control on personnel is described, and brief conclusions on the subject are mentioned. Mention is made of steps being taken to improve the control from a radiation protection point of view and what is being done in a coherent manner to arrive at better radiation hygiene methods in these mines. Insofar as the pilot plant is concerned, the purpose for which it was designed, and its present operating conditions are outlined. A description is made of working conditions, radiation-protection measures and medical control on workmen and technical personnel in the plant, as well as disposal of useless radioactive material from this project. The site where raw ore from the mines is stored for subsequent use at the plant is described. (auth)

16241 RELATIVE HAZARD OF THE VARIOUS RADIOACTIVE MATERIALS. Karl Z. Morgan, W. S. Snyder, and M. R. Ford (Oak Ridge National Lab., Tenn.). Health Phys., 10: 151-69(Mar. 1964).

An equation is given for the relative hazard, H, of various radionuclides under uniform working conditions. H is defined as the ratio of the average $\mu c/cm^3$ inhaled in the working area to the maximum permissible concentration, MPC, of the radionuclide for occupational exposure. The variation of H is discussed in relation to such parameters as radioactive and biological half lives of the radionuclides, fractional retention, dilution factors, specific activity, energy, RBE, relative damage factor, n, mass of the critical organ and the maximum permissible dose to the critical organ. Comparisons are made with values of H obtained by this and other investigations. The values of H obtained by this method appear to be consistent with estimates from operational experience. A table of values of specific activity, $(MPC)_E$ and relative hazard, H, are given for the radionuclides listed in ICRP Publication No. 2, plus values for a number of additional transuranic elements not previously listed by the ICRP. (auth)

16242 HEALTH PHYSICS FOLLOWING A NUCLEAR EXCURSION: THE LRL INCIDENT OF 26 MARCH 1963. R. L. Kathren, W. C. Day, D. H. Denham, and J. L. Brown (Univ. of California, Livermore). Health Phys., 10: 183-92(Mar. 1964).

On March 26, 1963 at approximately 0000 hr a nuclear excursion occurred in a shielded vault designed for critical assembly experiments. The excursion was estimated at 4×10^{17} fissions, and was followed by oxidation of the enriched U metal in the assembly. The fire was observed via closed circuit TV; later entry established that burning was limited to the assembly. Nearby combustibles did not burn or scorch. Disaster plans were immediately implemented to determine radiation exposures to personnel directly involved, the possibility of recurring criticality, and the extent of release of radioactive materials to the laboratory and to the off-site environment. Air and surface contamination levels were determined in the building housing the vault and at other points within the laboratory perimeter. Air, vegetation, and soil samples, obtained within hours following the excursion, were analyzed for fission product and alpha activity fallout. Results indicated the release of small amounts of short-lived, high-yield gaseous fission products and their daughters. No detectable alpha activity was released to the environment. The maximum exposure to any of the four persons in the building at the time was 120 mrems penetrating radiation. All neutron exposures were less than detectable limits, i.e., 50-mrem fast neutrons and 1-mrem thermal neutrons. Urinalyses, nasal wipes, and thyroid scans were all negative, indicating no internal exposure. An air sample taken from within the vault 57 hr after the excursion showed levels of $\sim 2 \times 10^{-6}$ $\mu C/cm^3$ of short-lived fission products. Radioactive decay and changing the vault air reduced these levels to below MPC values. The air exhausted from the vault was filtered and scrubbed with caustic before release to the atmosphere The initial vault entry was made to evaluate the possibility of a further excursion. The gross amounts of all fissile material were removed before decontamination operations were begun. The building, exclusive of the vault, was reoccupied 6 days after the incident. This incident reaffirms the value of carefully designed vault facilities for critical assembly work. (auth)

16243 THE RELATIONSHIP BETWEEN THE CONCENTRATIONS OF CALCIUM, STRONTIUM AND STRONTIUM-90 IN WILD BROWN TROUT, SALMO TRUTTA L. AND THE CONCENTRATIONS OF THE STABLE ELEMENTS IN SOME WATERS OF THE UNITED KINGDOM, AND THE IMPLICATIONS IN RADIOLOGICAL HEALTH STUDIES. W. L. Templeton and V. M. Brown (United Kingdom Atomic Energy Authority, Windscale Works, Cumberland, Eng.). Intern. J. Air Water Pollution, 8: 49-75(Jan. 1964).

The concentrations of Ca and Sr were measured in 20 surface fresh waters from the United Kingdom, and relations derived for the concentration of Sr and the ratio of atoms of Sr/1000 atoms of Ca, as a function of the Ca concentration of the water. Brown trout (Salmo trutta L.) and some other species of fresh-water fish were sampled from some of these waters and the Ca and Sr concentrations measured in bone, muscle tissue, and whole fish. The Ca concentration in bone and muscle tissue of brown trout was independent of the Ca concentration of the water, while the Sr concentration of the tissues was inversely related to the Sr concentration and hence, the Ca concentration of the water. In both bone and muscle tissue discrimination against Sr, relative to Ca, occurs. The Sr/Ca atom ratio in fish and plants reflects the Sr/Ca atom ratio of the water. The accumulation factors for Sr in brown trout ranged from 3.2×10^4 in bone and 80.0 in muscle tissue in waters of low Ca concentration, to 280 in bone and 1.0 in muscle tissue in waters of high Ca concentration. The determination of the concentration of ^{90}Sr from weapons fallout in brown trout tissues indicates that the degree of accumulation, and the relation with the Ca concentration of the water is comparable with that obtained for stable Sr. Predicted values of the concentration of ^{90}Sr in brown trout muscle tissue, at true equilibrium, and reflecting the contribution from both water and diet, in waters containing Ca in the range 0.36 to 100 Mg Ca/l and ^{90}Sr in the range 1.0 to 100.0 $\mu\mu C$ $^{90}Sr/l$ are presented. The radiological health implications are discussed. (auth)

16244 THE HUMAN-BODY COUNTER—A DETECTOR FOR DETERMINATION OF INCORPORATED RADIONUCLIDES. K. F. Poulheim and H. Hoesselbarth (Staatlichen Zentrale für Strahlenschutz, Berlin). Kernenergie, 7: 65-77(Feb. 1964). (In German)

The application of the human-body counter to radioactivity measurements essential to the maintenance of safety is discussed. This device can be used to determine: which nuclide is present in the body, the amount of this absorbed nuclide, the exact location in the body where the nuclide has accumulated, the length of time the nuclide has been active in the body, and what chemical process is taking place in the body. The proper application of the counter requires the consideration and solution of two basic problems. The first one is the reduction of the null effect, which is accomplished by shielding. Various designs of shielding chambers are discussed and compared. The second problem is that of increasing the measured effect and this relates to the instrument sensitivity, stability, energy transfer, and the spatial layout of detector components. All these factors are discussed and some specially developed scintillator designs are described. The next step in the application of the counter is the evaluation of measured data and their comparison with calibration curves. This is done in single- or multichannel pulse amplitude analyzers the design of which is also described. The status of human-body counter developments in the GDR is reviewed. (OTS)

16245 THE AMERICAN COMMUNITY LOOKS AT CIVIL DEFENSE. George V. Leroy (Univ. of Chicago). N. Y. State J. Med., 63: 1574-7(May 15, 1963).

Responsibilities of physicians in preparation for a nuclear attack are outlined. The effectiveness of each doctor in such emergency would be clearly related, first, to the extent to which he has prepared himself, and second, to the effectiveness of the larger organization of emergency health services of which he is necessarily a part. It is suggested that adequate civil defense measures may increase the chances of survival to more than 30 to 1. It is pointed out that physicians are uniquely qualified to counteract some of the apathy, indifference, and pessimism based on ignorance that characterizes the reaction of the average citizen to civil defense. Adequately trained and properly organized, the American medical profession could report truthfully that it was prepared for whatever disaster might come and that it would perform its traditional services faithfully and efficiently. Initial medical treatment of Japanese survivors of atomic bombing is discussed. Aid stations were established which were poorly organized but which managed to provide first aid. Each aid station cared for approximately 2000 to 4000 casualties during the first two weeks. In each station there were at the most one or two doctors, and only about 200 doctors were active at any one time in caring for casualties at

Hiroshima where the toll was from 60,000 to 80,000. Better organization and planning should make it possible for each doctor to treat 5 to 10 times as many people as was the case in Japan. After the detonation of a 1-Mt bomb over a modern urban area of several hundred square miles, the number of casualties able to reach aid stations might be as great as 500,000, and the number of dead outright might be another half million. The areas involved would include a central area of total destruction of 50 mi^2 and the area with serious casualties requiring care about 200 mi^2. An area of this size has a circumference of about 60 mi, and except at the downwind sector the intensity of fallout radiation at any point on the periphery should not exceed 30 r/hr at H plus one hr. To this periphery the casualties would come or be transported, and about this periphery could be located emergency medical facilities. Backing up the mobile emergency stations on the periphery of bombed areas there would be the undamaged hospital system. A fraction of the medical profession must serve in the aid stations, and another portion in the hospitals providing definitive and specialized care for the casualties. Another, smaller, portion would have to be administrators, assisting civil defense commanders, assigning emergency units, assigning hospital beds, supervising medical supply, and engaging in public health activities. Organization of physicians within local units is discussed. (BBB)

16246 CIVIL DEFENSE HEALTH PROGRAMS IN CANADA. A. C. Hardman (Dept. of National Health and Welfare, Ottawa). N. Y. State J. Med., 63: 1715-17(June 1, 1963).

Problems of civil defense planning in Canada are discussed in terms of a hypothetical attack in North America. The estimate of disaster was designed to indicate those areas in which effective care, was assigned to two agencies. The responsibility for planning in the prevention of radiation injury was divided between two other federal agencies. The Department of National Defence has established a nuclear detonation and radiation fallout warning system which will identify the point of detonation, size and height of burst, and predict fallout patterns for warning the population at risk. In addition, 2,000 fallout reporting stations are manned on a 24-hr basis and are capable of reporting to regional authorities the actual intensity of the radiation present at that point. The warning of the population will take place through the siren system and the Emergency Broadcasting Network of our Canadian Broadcasting Corporation. Plans for the production of shelter space have been assigned to the Emergency Measures Organization, with major reliance on individual action by families to provide shelter. However, surveys have been carried out of all suitable shelter space in existing government buildings, and the costs of converting such space have been determined. Measures to be executed at various postattack phases are outlined. Emphasis is placed on disaster planning for hospitals and municipal departments of health and the integration of such plans into a municipal disaster plan. An information and education program is directed to the general public in conjunction with other agencies, specifically in providing information on the types of health hazards and measures that could be taken to prevent spread of disease. The federal government has authority to stockpile some $18 million of supplies which will provide for 200,000 casualties for 21 days. A large portion of the stockpile has been procured and packaged for long-term storage and distributed to regional depots across the country. Some 200 200-bed hospitals have been procured as the first phase of a 500-hospital project. A survey is being conducted of available stocks of medical supplies and equipment and the production capability of industries, with a goal to make the municipality self-sufficient for seven days, the provinces self-sufficient for 30 days, and the country as a whole for six months. (BBB)

16247 X-RADIATION IN DENTAL OFFICES IN JEFFERSON COUNTY, ALABAMA. II. DARKROOM FACILITIES AND PROCESSING TECHNIQUES. A. H. Wuehrmann, H. C. Jamison, and L. R. Manson-Hing (Univ. of Alabama, Birmingham). Oral Surg., Oral Med., Oral Pathol., 16: 1450-7(Dec. 1963).

Although most users of ionizing radiation are constantly being subjected to increasing amounts of legislation designed to protect the public from excessive exposure, thus far, regulatory measures relating to dentistry have been concerned with barrier materials and use of protective leaded aprons for patients. No effort has been made to establish laws or regulations where professional judgment is required, and dentists are not restricted as to the number of exposures they may make or the speed of the film emulsion they must use. No individual or agency inspects the quality of the finished film or evaluates the individual practitioner's ability to interpret accurately the resultant roentgenogram; the dentist is simply expected to avoid needless, useless, or wasteful exposure of his patients. To assess the need for improved x-ray film development techniques, which would result in decreased patient exposure, a survey was made in 195 dentists' offices. Only 25 darkrooms examined had no apparent light leaks. There was no safelight in 7 darkrooms, and safelights were judged inadequate in 67 and adequate in 117 darkrooms. A solution thermometer was available in 106 of the 195 darkrooms. In 168 offices, film processing was done on a time-temperature basis (ordinarily 5 min development at 65°F or 4½ min at 68°). A solution-replenishing system was used in 23 darkrooms. The darkroom was also evaluated in its general appearance, tidiness, and arrangement on a subjective scale. Twenty-six darkrooms were rated good, 105 fair, and 60 poor. Twenty-seven of the offices reported that a sight developing technique was used, compared with 168 using a time-temperature technique. The time-temperature procedure did not follow manufacturer's directions in many of the offices because of the absence of solution thermometers and temperature-regulating equipment. A stop bath was used in only three offices. The interval of rinsing between developing and fixing of film ranged from no rinsing to 90 sec. The time intervals during which films were fixed ranged from 2 min to 2 hr. The inadequacy of many of the darkroom techniques is discussed and recommendations are made for improvements designed to reduce duration and repetition of x-ray exposures of patients. Nonoptimal film quality results in unnecessary patient exposure. (BBB)

16248 FIELD TRIAL OF A SYSTEM TO OBTAIN DATA ON POPULATION EXPOSURE TO X-RAYS. Joseph N. Gitlin, Charles R. Hayman, Gene Proctor, and Paul L. Roney. Public Health Rept., (U. S.), 79: 185-92(Mar. 1964).

A system to obtain data on population exposure to x rays included a household interview survey followed by a mail questionnaire to x-ray facilities. Separate report forms were used for medical and dental x-ray examinations. Film packs were designed and used to test the reliability of information on diagnostic radiographic units related to machine output, beam quality, size, and angulation. Results are reported on a field trial of the system in Berks County, Penna. This site had the desired urban-rural and socioeconomic characteristics. It was concluded that the methods, procedures, and forms used are appropriate for deriving estimates of population exposure to this source of

radiation and for obtaining data that are compatible with current research in dose model development. (C.H.)

16249 A DECONTAMINATION DEVICE FOR THE REMOVAL OF RADIOACTIVE STRONTIUM FROM WATER. F. Haghiri and G. E. Merva (Ohio Agricultural Experiment Station, Wooster). Soil Sci. Soc. Am. Proc., 28: 132(Jan.-Feb. 1964).

A Sr^{90}-removal device was designed for decontaminating runoff water from contaminated soils. The system is composed of coagulation tank, filter, cation-exchange resin columns, and check tank. Results indicate that the system is suitable for rapid and efficient decontamination of pond waters. (H.M.G.)

16250 ULTRASONIC DECONTAMINATION. Boško Pavlović and Desanka Novčič. Vojnotehnicki Glasnik, No. 5, 358-62(1962).

The applicability and advantages of ultrasonic decontamination are explained in non-technical language. It is mentioned (without further details) that experiments on ultrasonic decontamination (^{131}I and ^{32}P) were carried out, with favorable results for glass, plastics, and some metals, and unfavorable results for textiles. (TCO)

16251 CURRENT STATUS OF RADIATION HAZARDS. Moses A. Greenfield (Univ. of California, Los Angeles). X-Ray Technician, 33: 406-9(May 1962).

An evaluation of radiation hazards is presented and an attempt made to answer the following questions: what radiation dosages is man subjected to because of cosmic rays, natural radioactivity, and man-made radiation; what are the possible consequences of exceeding significantly the official recommendations; and what steps may one take to achieve reasonable protection against the hazard of excessive exposure. The total gonadal dose for the first 30 years of life is estimated to be 8.7 rad (4.0 from natural sources, 4.6 from medical sources, and 0.1 rad from fallout). Thus the estimated average existing man-made radiation exposure is already close to the upper limit of 10 rad prescribed by the National Academy of Sciences. At this time the single largest contribution comes from diagnostic radiology (4.1 rad). Genetic and somatic effects are also discussed and the conclusion reached that the available evidence still does not either confirm or deny the existence of a dose threshold for leukemia production. Steps necessary for reasonable protection are discussed and it is concluded that is is justifiable to design fixed radiology installations so that personnel do not receive more than $\frac{1}{3}$ of the maximum permissible dose for whole-body radiation over long periods of time. (BBB)

16252 RADIATSIONNAYA GIGIENA. TOM II. KOMMUNAL'NAYA GIGIENA. (Radiation Hygiene. Vol. II. Public Health). A. N. Marei, ed. Moscow, Medgiz, 1962. 225p.

Descriptions are given of natural and artificial ionizing radiation and its effects on populations. Aspects of certain regularities in the behavior of artificial radioactive materials in open water basins, atmosphere, and soil are discussed. Effects of fallout on populations are analyzed, and protective measures against radioactive contamination are suggested. Extensive references are included. (R.V.J.)

16253 PERSONNEL DOSIMETRY TECHNIQUES FOR EXTERNAL RADIATION; THEIR APPLICATION IN NUCLEAR INSTALLATIONS. MADRID SYMPOSIUM, 1963. Paris, European Nuclear Energy Agency, 1963. 510p.

Twenty-seven papers were presented on personnel dosimetry techniques for exposure to external radiation. Separate abstracts are included for 26 of the papers. The other paper was abstracted previously as BNL-6767 (NSA, 17: 14525). (H.M.G.)

For abstracts of individual papers see: 16254, 16255, 16256, 16257, 16258, 16259, 16260, 16261, 16262, 16263, 16264, 16265, 16266, 16267, 16268, 16355, 16356, 16357, 16358, 16359, 16360, 16361, 16362, 16363, 16364, and 16365.

16254 BIOLOGICAL ASPECTS OF THE APPLICATION OF RADIATION PROTECTION NORMS IN NUCLEAR INSTALLATIONS. H. Jammet (Commissariat à l'Energie Atomique, Fontenay-aux-Roses, France). p.25-34 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

The biological aspects of the application of radiation protection norms in nuclear installations correspond in fact to the health requirements for protection against occupational diseases. These are based on the principle that workers should not be exposed to radiation in excess of a certain level, (Maximum Permissible Dose). The form of irradiation, the nature of the radiation and the various classes of workers must all be taken into account. As regards the form of irradiation, a distinction must be drawn between irradiation of the whole body and irradiation of parts of the body. More detailed regulations are laid down governing ordinary working conditions and exceptional conditions of accumulated or accidental exposure. For certain parts of the body, the nature of the radiation is the preponderant factor. Specific maximum permissible levels are laid down for neutrons, as a function of their energy. An especially important problem is that of determining such levels for very-high-energy radiation and especially for protons generated by particle accelerators. From the biological viewpoint, all the foregoing considerations apply to male workers over the age of 18. Two special types of problems arise in the case of adolescents under 18 years of age, and of women of child-bearing age and pregnant women. All biological considerations lead to the fixing of levels which individual dosimetry should be capable of controlling as precisely as possible. (auth)

16255 PROBLEMS IN THE APPLICATION OF NORMS OF EXTERNAL RADIATION. Lauriston S. Taylor (National Bureau of Standards, Washington, D. C.). p.35-47 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

Radiation protection norms or standards have evolved over the past three decades to the point where there is general acceptance of the principles involved. Within the past few years such standards have become embodied in laws and regulations, with the result of introducing a kind of rigidity never intended by those groups that developed them. This rigidity tends to hamper further developments of norms, through fear of necessitating changes in existing codes and regulations. At the same time the sensitivity of the public to radiation hazards has grown sharply, so that whereas in the early days only a relatively few workers in the field were concerned, now the entire public seems concerned. It has been recognized for many years that the establishment of protection norms for radiation, as for other fields, involves many subjective considerations and judgment values. More recently it has become appreciated that they may involve social, political and economic considerations. Furthermore, all existing norms are developed within a framework of no observable effect. The influence of these considerations on the understanding and acceptance of norms, by the public as well as governmental bodies, is

discussed, and an endeavor is made to bring these various facets of the problem into suitable perspective. (auth)

16256 USE OF PHOTOGRAPHIC FILM FOR PERSONNEL DOSIMETRY; BASIC PHYSICAL CONSIDERATIONS. Margarete Ehrlich (National Bureau of Standards, Washington, D. C.). p.49-74 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

Personnel dosimeters are required for the measurement of absorbed whole-body and organ doses ranging from those due to man's natural radioactive environment up to 800 to 1,000 rem. The physical principles of the response of photographic film to high-energy ionizing radiation and of the use of photographic film in radiation dosimetry form the main topics of this paper. After some introductory remarks on the photographic process, the influence of specific energy loss and particle range on photographic sensitivity is considered for photons, electrons and neutrons. Side effects, such as reciprocity failure, solarization, fading, as well as the dependence of sensitivity on radiation energy and direction, are treated in some detail, and methods for reducing errors due to these effects are outlined. The importance of the choice of film holder (badge), film type, and processing reagents are stressed. A brief description and critical evaluation follows of the multi-filter, single-filter and film-scintillator methods used in photon dosimetry, of proton-track counting used in fast-neutron dosimetry, and of accepted methods for the photographic dosimetry of β rays and thermal neutrons. Some time is spent, in conclusion, on an outline of sound calibration and evaluation procedure, and on a discussion of accuracies attainable with the photographic method. (auth)

16257 PAST EXPERIENCE AND PRESENT PRACTICE WITH FILM DOSIMETRY. F. Duhamel and G. Soudain (Centre d'Études Nucléaires, Saclay, France). p.77-87 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

For individual personnel dosimetry, photographic emulsions have so far been used in the personnel dosimeters in France at the Commissariat à l'Energie Atomique. The Commissariat à l'Energie Atomique has used photographic films for dosimetry since 1948. Despite its inherent defects, this method has so far proved most useful and has been gradually improved in order to record as accurately as possible the doses actually absorbed by personnel exposed to radiation. Besides a historical review of the subject, this paper sets out the technical reasons for the various stages of development, the principles on which the photometry laboratory is organized and the various aspects of current photography practice (emulsions, screens and screen-holders, frames and badges, and processing of data collected). (auth)

16258 A NEW FILM HOLDER FOR PERSONNEL DOSIMETRY. M. J. Heard and B. E. Jones (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.89-109 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (AERE-M-1178)

Film holders for personnel dosimetry should be capable of giving a fairly accurate estimate (±20%) of the dose at the surface of the body for radiation exposures which involve mixtures of type and energy of radiation. They should also provide simple information to make possible the separation of the contributions of different types of radiation and spectral information for the separation of effects at the surface and at depth. In special cases, where exposure conditions are well understood, it is often possible to use simple, specialized holders. However, in general, it is desirable to have a versatile holder that will deal with a wide variety of conditions. A holder of this type has been developed in the United Kingdom by the United Kingdom Atomic Energy Authority (UKAEA) and the Radiological Protection Service. It replaces the existing UKAEA holder which was designed primarily for γ radiation and the R.P.S. holder which was effective for photon radiation but not for β radiation. The new holder provides six filtered areas together with space in the unfiltered area for an identification number on the film packet. Detailed response data for the various filtered areas of the film for variation of radiation type, energy and angle of incidence are given. A simple and a more complex method of assessing total dose in exposure to radiation mixtures is discussed. Separate dose estimates are produced for slow neutrons, β radiation (energy range 0.25 to 3.5 Mev) and photon radiation (15 kev to 2 Mev). Response to radiation outside these limits is also discussed. (auth)

16259 BIOLOGICAL METHODS IN PERSONNEL DOSIMETRY. E. H. Graul (Philipps Universität, Marburg, Ger.). p.111-56 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The extent of the biological effects of exposure of the human organism to ionizing radiation does not depend only upon the amount of radiation energy absorbed by the tissue. Total-body irradiation experiments carried out on mammals in the LD_{50}-LD_{100} range yielded characteristic mortality curves, but these provided no information as to the fate of the individual animals. Tests showed that in this particular critical dose range there are marked individual differences in sensitivity to radiation; under identical conditions animal A may survive a dose of 900 rem whereas animal B will succumb to 250 rem. Thus, for biological reasons, and also for various physical reasons (e.g., nonhomogeneous dose distribution), it is necessary to detect the (clinical) extent of radioinduced alterations in the organism by means of biological methods. In principle, there are several biological systems which show the reaction of the human organism to total-body or partial-body irradiation as a function of the dose. Such systems for detecting biological reactions are described in relation to their sensitivity to radiation, with particular emphasis on their suitability for practical use. On the basis of extensive clinical and animal tests, two procedures developed for individual biological dosimetry are presented, and their performance is discussed: early and rapid diagnosis of radiation damage by determining the number, size distribution and resistance of cellular blood components (erythrocytes, leucocytes and particularly platelets) with the aid of an automatic counting device; the behavior of the serum-quenching effect in a tritium-activated liquid scintillation system after total-body irradiation with various rem doses. In conclusion, the possibilities of future research and development work in the field of individual biological dosimetry are discussed. (auth)

16260 MEASUREMENT OF EXTERNAL RADIATION DOSES BY SOLID STATE DOSIMETRY. W. Hanle and A. Scharmann (Universität, Giessen, Ger.). p.159-72 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The following dose-measuring methods are described:

thermoluminescence dosimetry; radiophotoluminescence dosimetry; dosimetry with phosphorus stimulated by infrared light; dosimetry by coloration of glasses and plastics; semi-conductor detectors; and exoelectron emission dosimetry. The limitations of the above methods are particularly discussed. (auth)

16261 A METHOD OF RECORDING INDIVIDUAL DOSES AND DOSE RATES DURING RADIATION WORK. Rolf M. Sievert (Inst. of Radiophysics, Sweden). p.173-88 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

A small type of instrument to be worn by radiation workers in order to register radiation exposure was described earlier. These instruments have a time dial on which a mark is obtained each time a dose increment of predetermined magnitude is accumulated. The instruments can be adapted for dose increments from about 10 mr up to 1 r, thus showing the distribution in time of the radiation dose received. Some experience of using instruments of this type is reported, together with further development of the method using short-wave transmitters enabling the recording at a distance of the dose per minute and total accumulated dose received by radiological workers. (auth)

16262 THE NUCLEAR STARS IN PERSONNEL NEUTRON TRACK FILMS CARRIED AT CERN. J. Baarli and J. Dutrannois (CERN, Geneva). p.283-301 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

A review of the procedure applied at CERN to personnel-monitoring neutron films is given. This includes the methods of storing, packaging, carrying, calibrating, developing and reading the films. An analysis was made of the results from 1,548 film badges to determine the frequencies of tracks and stars. It was found that nuclear stars are frequently found in films carried in experimental regions near the CERN 28-Bev proton synchrotron. An estimation of the body dose was made, using existing nuclear data. The results are compared with the observation in neutron track films exposed in a 400-Mev neutron beam. (auth)

16263 THE DERIVATION OF ABSORBED TISSUE DOSES FROM THE RESULTS OF PERSONNEL DOSIMETRY TECHNIQUES. N. Adams (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). p.413-26 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

A method by which estimates of the absorbed tissue doses to critical organs of the body may be made from the results obtained from film dosimeters worn on the surface of the body is described. Where a simple photographic dosimeter is employed, incorporating for example a single filtered area and an open window, which may be taken to register the effect of γ rays and (γ rays + x-rays + β rays), respectively, an observed blackening pattern on the film does not uniquely determine the types and proportions of the radiations that produce it. In such a case it is shown that, by making certain simplifying assumptions, an estimate of the maximum dose to an internal organ of the body may be made that is consistent with the film measurements. The use of a film holder incorporating several filters enables a more accurate assessment of the tissue doses delivered to organs lying below the surface of the body. (auth)

16264 BIOLOGICAL SIGNIFICANCE OF THE RESULTS OBTAINED BY PERSONNEL DOSIMETRY OF EXTERNAL RADIATION. A. Lafontaine (Institut d'Hygiène et d'Epidémiologie, Brussels). p.427-40 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

Progress in dosimetry techniques has led to greater accuracy in the results, but insofar as personnel dosimetry is concerned there is still a considerable margin of uncertainty even when all the organizational factors are satisfactorily resolved. One of the main reasons for this uncertainty is the frequent complexity of the phenomena to be measured. Even the tissue effects of the absorbed doses differ, depending on the individual and his physiological or pathological condition, the organ affected, the importance of the resulting injury for the system as a whole and on the dose distribution in terms of time, and all this in respect of external radiation alone. Moreover, other uncertainties are linked with the fact that doses measured in the air are determined only at certain points in relation to the body, and it is thus difficult to deduce the actual doses received by the whole body or by certain specific organs. Hence, every measurement should be accompanied by an interpretation in which the biological and medical factors are given equal importance with the physical factors; the most standardized method possible should be chosen, to permit comparison of the results and the application of basic norms; and to choose conventional conditions is not to abdicate in face of the difficulties encountered. It enables an interpretation that is biased in one direction or the other to be avoided, a uniformly acceptable standardization and calibration to be achieved; it will provide a series of guide marks to which reference can be made when the biological significance of what is measured is established with greater certainty, and will probably open up the way for a revision of the basic norms. (auth)

16265 EXTERNAL RADIATION DOSIMETRY PRACTICES IN THE UNITED STATES. D. M. Ross (Atomic Energy Commission, Washington, D. C.). p.443-53 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

Individuals and companies in the nuclear industry in the U. S., whether operating a Government-owned facility under contract or licensed to use radioactive materials, are required to monitor the radiation dose received by their employees. The decision to develop appropriate procedures and do this job themselves or purchase the service from one of twenty commercial vendors is left to the discretion and judgment of the contractor or the licensee. Certain characteristics of a personnel film badge dosimetry system are discussed briefly. Two efforts are at present under way in the U. S. to develop standards which may have the effect of lending more validity to the myriad measurements that are being accumulated annually. First, the AEC is seeking to establish film badge dosimetry performance standards and to measure compliance with them at a Film Badge Dosimetry Standardization Laboratory. Secondly, the American Standards Association has established Subcommittee No. 2.6 on Administrative Practices in Radiation Monitoring to answer such questions as: what data are necessary; what accuracy is required; and how should results be reported? (auth)

16266 EXTERNAL RADIATION DOSIMETRY PRACTICE IN THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY. W. A. Langmead (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). p.455-73 of

"Personnel Dosimetry Techniques for External Radiation; Their Application In Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The philosophy and purpose of personnel dosimetry is discussed and the requirements for external radiation in the U.K. Atomic Energy Authority are reviewed in relation to the legislation and regulations operating in the United Kingdom. The operational use of film and other dosimeters for routine and special purpose monitoring and the methods employed for the calibration of these instruments are described. The relation between area and personnel monitoring in the control of personal dose is discussed, and the system of record keeping adopted in the establishments of the Authority is also described. The radiation units in which doses are measured and recorded, and the use of the rad-in-air and the rem in personnel dosimetry are examined. (auth)

16267 EXTERNAL RADIATION DOSIMETRY PRACTICES IN THE COMMISSARIAT À L'ENERGIE ATOMIQUE, FRANCE. P. Candes, J. M. Lavie, and M. Bricka (Commissariat à l'Energie Atomique, Fontenay-aux-Roses, France). p.475-87 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

The monitoring of external irradiation is based on the assessment of three types of dose: the exposure dose, the absorbed dose, and the Relative Biological Efficiency (RBE) dose, the ultimate aim being to determine the RBE dose in relation to the varied nature of the radiation involved. To assess this latter dose, it is necessary to ascertain, in addition to the absorbed (i.e., first collision) dose, the radiation spectrum and the value of the RBE factor. The various types of instruments at present available for routine dose measurement are discussed in the light of this consideration, a distinction being made between those designed for measuring dose rates and those designed for measuring the absorbed dose. The conclusion drawn is that though γ dosimetry or the measurement of absorbed doses is possible at every energy level, and the RBE dose can be easily ascertained, the question of neutron dose measurement is more complicated, especially in the event of heavy accidental irradiation. The measurement of the absorbed first collision dose is feasible at present, but the next step, which consists in working out the RBE dose, is still difficult because the determination in the routine or accidental cases of the energy spectrum was not yet satisfactorily settled. For these various reasons, instruments for routine or accidental dosimetry were, or are being developed to enable the RBE dose to be read with sufficient accuracy for radiation protection purposes. In this same context, having regard for the actual shortcomings of dose measurement equipment, especially for spectrometry, it might be useful to devise, for a given plant with invariable environmental irradiation properties within the time and a given area, an equivalent measurable RBE factor based on the concept of equivalent energy. By a careful and detailed prior investigation, using advanced physics apparatus, of the radiation spectrum likely to be emitted under normal working conditions or in the case of an incident in a given plant, it is possible to define this plant RBE concept and to analyze its content. Routine and accidental dosimetry can thus be both simplified and improved. (auth)

16268 EXTERNAL RADIATION DOSIMETRY PRACTICE IN THE "JUNTA DE ENERGIA NUCLEAR." E. Ramos Rodriguez and R. Gonzalez del Campo (Junta de Energia Nuclear, Madrid). p.489-502 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The personnel dosimetry practice carried out for the Junta de Energia Nuclear at the Health Physics Laboratory of the Juan Vigon National Centre for Nuclear Energy in Madrid is described. An account is given of the routine photographic personnel monitoring procedures, and the film holders for β- and γ-ray and neutron monitoring; films, film-badge assembly, badge identification, calibration, processing, evaluation, exposure record, monitoring periods and exposure range monitored are described. (auth)

16269 STATE'S ROLE IN LOCAL RADIATION EMERGENCIES. Lyle D. Thomas (Public Health Service, Chicago). 8p. (CONF-277-7)

From Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963.

Historically the responsibility of a Federal agency, radiological health is increasingly being integrated into the overall emergency program at the state level. Most states now have enabling legislation and specific regulations for radiation protection. Thus, the basic authority exists. Features of state radiological health programs discussed are a trained radiological health staff, adequate instrumentation, and a comprehensive communications network. Importance of the state police agency as a resource in radiological emergencies is stressed. Indiana State Board of Health experience with such a program is reviewed. (H.M.G.)

16270 MENTAL PREPAREDNESS OF EMERGENCY PERSONNEL. Donald Oken. 25p. (CONF-277-8)

From Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963.

Attention is directed to the phenomenon of anxiety and human behavior under stressful conditions, both mild and severe. It is proposed that almost everyone involved in a major radiation incident would develop some anxiety, a few individuals developing terror or becoming abjectly dazed. Thus all emergency personnel should be prepared to apply therapeutic measures. To combat traumatic disturbances caused by fear of the unknown, the nuclear scientist should provide concrete, tangible, realistic, familiar images of radiation and its effects. Because of the importance of group dynamics, leaders must be chosen with great care. The capacity to withstand stresses faced in the course of carrying out effective function is cited as the most important trait in emergency personnel. A prime outcome of personnel training should be the development of a strong esprit de corps. Training programs designed to provide contact with stressful experience prior to practical work at real disasters are recommended. The roles of adequate information on radiation and knowledge of accident prevention techniques are emphasized. (H.M.G.)

16271 METHOD AND APPARATUS FOR ANALYSIS OF PARTICLES IN A GASEOUS STREAM. (to National Spectrographic Labs., Inc.). British Patent 951,120. Mar. 4, 1964. Priority date Feb. 15, 1960, United States.

A method and apparatus are described for determining amounts of airborne toxic materials, such as beryllium oxide. The method comprises filter collection with correlation to gas volume and spectrographic examination of the collected material. (R.E.U.)

16272 PROTECTIVE CLOTHING. Anthony Charles Thorne and Richard John May (to Spembly Ltd.). British Patent 952,561. Mar. 18, 1964. Filed Jan. 12, 1962.

A protective suit of an impermeable material with the head portion, arms, and legs making tightly sealed connections with a body portion is described. An entry aperture is formed in the back of the body portion through which a person may don and evacuate the suit. The aperture extends horizontally across the full width of the body and vertically from a line joining the underside of the armpits to the waist. A means, operable by a person in the suit is available to seal the aperture. This sealing means includes a skirt portion, extending from and around the periphery of the aperture of such length that when the suit is donned by the wearer the skirt will hang down to cover the aperture. The skirt lip can be folded up on itself and be secured around the body by ties. (M.C.G.)

16273 IMPROVEMENTS RELATING TO RADIOACTIVITY ALARM SYSTEMS. Dennis Allenden (to Associated Electrical Industries Ltd.). British Patent 952,948. Mar. 18, 1964. Filed Feb. 12, 1962.

An alarm system for a radioactivity air sampling monitor in which the sampling time is automatically adjusted to suit the particular contamination level involved is described. The apparatus includes a dust sampling device and a detector responsive at the end of each sampling period to the radioactivity level of the sample collected in that period. A counter, operable by the detector, indicates the level of radioactivity after a certain counting period has elapsed. A device resets the counter to zero at the end of each counting period. An alarm is actuated by the counter on exceeding a predetermined maximum count. At a predetermined lower count in one of the counting periods a switching means is actuated by the counter to temporarily inhibit the reset device so that the counter counts over a number of successive sampling periods and registers the total count for all these periods. (M.C.G.)

16274 RADIOACTIVE SOURCE SHIELDING DEVICE WITH SAFETY LATCHING MEANS. Raymond L. Meeder and Charles E. Mielke (to Nuclear-Chicago Corp.). U. S. Patent 3,126,484. Mar. 24, 1964. Filed Jan. 5, 1960.

A device for the storage of a radiation source such as a surface moisture probe, is designed which minimized the possibility of accidential exposure of personnel to radiation. The device includes means to expose the source outside the shield, a handle to encase the source in the shield when pulled upward, a manually operable latch securing the handle in the raised position, a protective cover with an abutment which blocks release of the latch, and means responsive to source insertion in the shield to move the latch to allow closing of the cover on the device. (D.L.C.)

INSTRUMENTATION

General

16275 (AERE-M-1332) RECORDING SYSTEMS FOR USE WITH HARWELL SOLID-STATE SCALERS. J. M. Richards, R. C. M. Barnes, L. Naylor, C. N. Davey, and G. C. Best (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Jan. 1964. 15p.

Two recording systems were developed for use with Harwell's latest range of direct access scalers, which have pulse resolutions of 1, 0.1, and 0.01 μsec. The simpler system (Type 3017) allows up to four 6-decade scalers to be recorded by an Addo X printer, and will be sufficient for most counting experiments. The other (Type 3016) is designed for larger numbers of scalers and is more versatile. The scalers in an installation can be grouped into modules, each with a Module Controller allowing an independent sequence of reset, count, print and sample change, and all served by a common Recording Controller. The scalers of any module which demands print-out are connected, in turn, by the Recording Controller to one or more recording devices such as a parallel printer, a serial printer, a tape or card punch or a magnetic tape recorder. (auth)

16276 (LA-3031) A NEW SOLUTION CALORIMETER. George C. Fitzgibbon, Daniel Pavone, Elmer J. Huber, Jr., and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). Dec. 1963. Contract W-7405-eng-36. 24p.

The design and operation of an isothermal solution calorimeter are described. A new feature is the continuous automatic recording of the calorimeter temperature. (auth)

16277 (NASA-TN-D-2264) EFFECTS OF CESIUM VAPOR ON BAYARD-ALPERT IONIZATION GAGES AT PRESSURES LESS THAN 10^{-5} TORR. Robert L. Summers (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Mar. 1964. 15p.

A study was conducted to determine the effects of cesium vapor on ionization gages. Although no permanent damage to the gages was noted over a period of months, temporary gage failure due to cesium plating on the gage was noted after a few hours at cesium pressures above 10^{-6} torr. At pressures below 10^{-6} torr, the response of the gage to changes in cesium pressure was inhibited by the condensation of cesium on the envelope and tubulation. For stable pressure readings from the gage, periods of several hours were required. The ionization-gage sensitivity to cesium was 13.7 times the gage air sensitivity, with a probable error of 14%. (auth)

16278 (NP-13717) VAKUUMMETR, ISPOL'ZUYUSHCHII GAZOVYI RAZRYAD NA PEREMENNOM TOKE. (A Vacuum Gage Using an Alternating Current Gas Discharge). G. Ya. Nizhin (Akademiya Nauk Ukr. S.S.R. Fiziko-Tekhnicheskii Institut). 1963. 4p.

Descriptions are given of a vacuum gage using a-c gas discharge and capable of measuring pressures of several tens to 10^{-5} mm Hg. (R.V.J.)

16279 (NP-13746) METHODS OF EVALUATING RADIOLOGICAL EQUIPMENT AND MATERIALS. Recommendations of the International Commission on Radiological Units and Measurements. Report 10f 1962. (National Bureau of Standards, Washington, D. C.). Aug. 23, 1963. 40p. (NBS-Handbook-89)

Changing concepts of methods, materials, and systems in medical radiology call for agreement on methods for measurement and evaluation of radiological materials and systems. Recommendations are offerred as a basis for standards in this area. These recommendations cover the measurement of focal spots, of the conversion factor of x-ray image intensifiers, of the characteristics of grids, and of the characteristics of body-section radiographic equipment. An appendix on radiation quantities and units is included. (D.L.C.)

16280 (SC-TM-328-62(72)) AN AIRBORNE VIBRATION ANALYSIS SYSTEM. C. L. Schuster (Sandia Corp., Albuquerque, N. Mex.). Jan. 1963. Contract AT(29-1)-789. 15p.

Description of a new system for obtaining airborne vibration data is given. The technique is to pre-analyze the data with band pass filters and transmit the peak vibrations from several filter bands. (auth)

16281 AN ATOMIC ABSORPTION SPECTROPHOTOMETER. Herbert L. Kahn and Walter Slavin (Perkin-Elmer Corp., Norwalk, Conn.). Appl. Opt., 2: 931-6(Sept. 1963).

A double-beam, single-detector, time-sharing spectrophotometer was designed with optimum parameters for the atomic absorption technique. The monochromator is a dual-grating, high-dispersion, Ebert–Fastie type. The major requirements of an atomic absorption spectrophotometer are stability, a wide range of slit-widths, and minimum sensitivity to emission from the flame. Many of the traditional requirements of an ultraviolet spectrophotometer can be relaxed. Ordinate scale expansion makes it possible to achieve lower detectability limits. With the present design, it is possible to measure concentrations of less than 0.1 ppm of copper, cadmium, and chromium with coefficients of variation of less than 10%. (auth)

16282 THE FIELD-EFFECT TRANSISTOR—AN OLD DEVICE WITH NEW PROMISE. J. T. Wallmark (Radio Corp. of America, Camden, N. J.). IEEE (Inst. Elec. Electron. Engrs.), Spectrum, 1: 182-91(Mar. 1964).

The characteristics and performance limits of field-effect transistors are discussed to the extent that they are different from those of bipolar transistors. The technical possibilities of unipolar field-effect transistors as active devices and as building blocks for integrated circuits are reassessed. (P.C.H.)

16283 CHARACTERISTICS OF HIGH VOLTAGE VORTEX-STABILIZED ARC HEATERS. R. C. Eschenbach, D. A. Bryson, H. B. Sargent, R. J. Sarlitto, and H. H. Troue (Union Carbide Corp., Indianapolis, Ind.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 41-6(Jan. 1964).

Phenomena occurring in a particular vortex-stabilized geometry are discussed. In arc heaters of this type, voltage increases linearly with flow and with size. The level of performance for various sizes is both predictable and fairly constant. Smoke techniques have elucidated reentrant flow patterns associated with the vortex flow, and windows permit studying the effect of an auxiliary magnetic field on arc rotation. Measurements of effluent fluctuations are reported. (auth)

16284 REDUNDANT PULSE HEIGHT DISCRIMINATOR. Richard H. Wagner (Bendix Corp., Southfield, Mich.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 308-13(Jan. 1964).

A semiconductor pulse-height discriminator and driver amplifier was developed that will operate reliably for long periods of time aboard unattended space craft. Adequate threshold stability under variable temperature and supply voltage conditions is provided by a new tunnel-diode circuit. Active parallel circuit redundancy is employed to enhance reliability. The resulting circuit tolerates opens or shorts in any of the semiconductors with little performance degradation. (auth)

16285 A STABILIZED SWITCHING IGNITRON. David B. Cummings (Univ. of California, Berkeley). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 345-50(Jan. 1964). (UCRL-7391)

Ignitrons switching high-current pulses are troubled by arc transfer to the wall. An ignitron was made with the anode closer to the cathode (1 cm) than to the wall (3 cm). It was tested successfully as a capacitor-bank crowbar (clamp) tube at 12 kv with two different current wave shapes. The first was 3 kiloamperes (ka) decaying with a 230-msec time constant (690 coulombs). The second was 55 ka decaying with a 12-msec time constant (660 coulombs). There was no indication of arc transfer damage on the wall. Also, as expected, the arc drop voltage decreased much faster (10 μsec vs 60 μsec) than a conventionally-spaced 5-inch ignitron and reached a 20% lower value. (auth)

16286 EFFECT OF ION ENGINE EXHAUST ON TELEMETRY SYSTEMS. Philip Parzen (Radio Corp. of America, Princeton, N. J.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 351-7(Jan. 1964).

A theory of the modification of the radiation pattern of a dipole antenna by the ion engine exhaust is given. A theory of fluctuations in the beam is worked out. The effect of the fluctuations is to randomly modulate a signal carrier in phase and in amplitude. Its effect on an FM-FM telemetry system is to cause a 4-db degradation in signal-to-noise voltage output. (auth)

16287 DESIGN AND CONSTRUCTION OF A BERREMAN-TYPE POINT-FOCUSING X-RAY MONOCHROMATOR FOR USE IN LOW-ANGLE SCATTERING STUDIES. William E. Dibble and Jesse W. M. Dumond (California Inst. of Tech., Pasadena). J. Ultrastruct. Res., 9: 419-44(Dec. 1963).

The design and construction of a point-focusing single quartz crystal x-ray monochromator for low-angle scattering are described. Monochromatization and point focusing of the copper $K\alpha_1$ line are obtained by Bragg reflection from an appropriately bent $2^1/_2$ by $2^3/_4$ by 0.015 in. crystal lamina. With a 0.0225-in. aperture defining the size of the x-ray source next to a General Electric CA-7 diffraction tube running at 45 kv and 18 ma, about 3×10^9 counts/min may be put into a 0.025-in. half-width focus, in helium atmosphere. Parasitic scattering from the crystal which competes with scattering from the sample was excluded by using a converging vane collimator, which required coating with lead chloride to prevent low-angle total reflection from the vanes. Sample-to-detector distances of up to 49 cm are obtainable. Keratin and albumin scattering patterns are shown to illustrate the instrument's performance. (BBB)

16288 WATER MONITORING SYSTEM (Engineering Materials). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). (CAPE-1085)

Seventeen drawings and 1 specification are included. The system is used to automatically monitor variables on 113 sample streams coming from various reactor cooling systems. The streams are monitored for pH, conductivity, chlorides, sodium, oxygen, hardness, hydrogen, hydrazine, and radiation. Results are printed out on 35 recorders. Annunciators warn of any variables that exceed preset limits. (F.S.)

16289 IMPROVEMENTS RELATING TO MASS SPECTROMETERS. Brian Noel Green (to Associated Electrical Industries Ltd.). British Patent 951,687. Mar. 11, 1964. Filed Dec. 22, 1961.

A mass spectrometer ion collecting apparatus is designed for suppressing adverse effects due to secondary emission in the apparatus. The apparatus comprises a collector member coated with a layer sensitive to ions, an electrode extending over the layer and spaced therefrom, means for applying a positive potential to the electrode to attract the negatively charged secondary particles emitted from the sensitive layer, and a slit extending along the electrode to pass the primary ions on to the sensitive layer. (D.L.C.)

16290 SUPERCONDUCTIVE DEVICE UTILIZING A FERROMAGNETIC SUPERCONDUCTIVE ELEMENT. John L. Rogers (to Space Technology Labs., Inc.). U. S. Patent 3,125,688. Mar. 17, 1964. Filed Jan. 11, 1960.

A thin-film superconductive gating device is designed for realizing high switching speed while preserving gain. The device comprises superconductive gate and control elements and a memory unit. The gate element is a thin film of a material that is both superconductive and ferromagnetic at its superconductive operating temperature. An electric current is passed through the control element to develop a magnetic field for changing the state of the gate element from the superconductive to the resistive magnetized condition. The memory unit utilizes the remanent magnetization of the gate element to effect a storage of information. (D.L.C.)

16291 MULTIPLE DISPERSION MASS SPECTROMETER. Tamotsu Noda and Nozomu Morito (to Kabushiki Kaisha Hitachi Seisakusho). U. S. Patent 3,126,477. Mar. 24, 1964. Priority date Jan. 12, 1960, Japan.

A new mass spectrometer is designed in which high resolving power is obtained without enlargement of the apparatus. Ion mirrors are used to give the same effect as that of increasing the radius of ion orbit. Several embodiments of the spectrometer are described. (D.L.C.)

16292 X-RAY ANALYZER SYSTEM WITH IONIZATION DETECTOR CONTAINING NITROGEN, HELIUM AND A LOW ATOMIC NUMBER OF QUENCHING GAS. Rodney A. Mattson (to General Electric Co.). U. S. Patent 3,126,479. Mar. 24, 1964. Filed Mar. 1, 1962.

An x-ray emission analyzer is designed with a gas-flow proportional detector. The detector contains a gas fill of nitrogen, helium, and methane or other hydrocarbon gas as a quenching agent, and is more sensitive to low-energy than to high-energy x rays. (D.L.C.)

Radiation Detection

Refer also to abstracts 16257, 16258, 16261 and 17246.

16293 (BNL-7534(p.107-12)) HIGH-ENERGY PHYSICS WITH A LARGE HEAVY-LIQUID BUBBLE CHAMBER. W. D. Walker (Wisconsin. Univ., Madison).

The future design of heavy-liquid bubble chambers to accommodate analyses of interactions of higher energy particles is discussed. A cylindrical multiwindow chamber is proposed. (R.E.U.)

16294 (BNL-7534(p.113-27)) THE USE OF A LARGE, HEAVY-LIQUID CHAMBER AT HIGH-ENERGY ACCELERATORS. I. A. Pless (Massachusetts Inst. of Tech., Cambridge).

The usefulness of a heavy-liquid bubble chamber, with or without internal hydrogen target, used in conjunction with a high-energy ($E \geq 10$ Bev) accelerator is discussed. The characteristics of a proposed five-cubic-meter heavy-liquid chamber are described. (R.E.U.)

16295 (BNL-7534(p.318-23)) A POSSIBLE "NEW" DETECTION TECHNIQUE. E. C. Fowler (Duke Univ., Durham, N. C.).

A "new-type" Wilson cloud chamber is proposed that provides for triggering with a delay time of 1 msec, a sensitive time of 2 msec, and resolving time of 0.1 msec. Space resolution varies 0.1 as compared to 0.07 for a hydrogen bubble chamber and the thickness of a one-meter path is 0.04 grams/cm^2 (for $\frac{1}{2}$ atm. of H_2O vapor). (R.E.U.)

16296 (CERN-64-13(Vol.I)(p.87-129)) KINEMATICAL ANALYSIS OF BUBBLE CHAMBER PICTURES. B. Ronne (European Organization for Nuclear Research, Geneva).

The analysis of bubble chamber pictures at CERN is described. The preliminary treatment of the pictures and the geometrical reconstruction of the tracks are outlined, and the kinematical calculations are described. An experiment on negative cascade hyperons is used as an example. Two types of hypotheses often tested in comparing experimental and theoretical results are also illustrated. (D.C.W.)

16297 (HW-79027) REPLACEMENT AND IMPROVEMENT OF FIXED RADIATION MONITORING INSTRUMENTATION [OF] EXISTING HANFORD PRODUCTION REACTOR AREAS—DESIGN CRITERIA. W. R. Thorson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 22, 1963. Contract AT(45-1)-1350. 19p.

Objectives, bases, and functional requirements are defined for the modification of fixed radiation monitoring in several Hanford buildings to provide better radiological safety in the reactor areas. The improvements will provide six decades of continuous gamma monitoring, standardization of alarms, and standardization of recording instruments with capabilities of establishing the radiation level, location, and time of an incident. (D.L.C.)

16298 (K-1589) A FIXED FILTER PAPER ALPHA AIR MONITOR. B. G. Seaborn (Oak Ridge Gaseous Diffusion Plant, Tenn.). Mar. 23, 1964. Contract W-7405-eng-26. 18p.

An instrument has been developed for the detection of uranium dust in the atmosphere. The principle feature of this device is its ability to indicate a gross release of alpha radiation within a few minutes of its occurrence. The unit will sound an alarm when either the indicated level or the rate of increase exceeds preset values above normal background variations. (auth)

16299 (LAMS-2977) A COMPARISON OF THE NEUTRON DOSE RATES OBTAINED WITH THE SINGLE-SPHERE INSTRUMENT, MULTISPHERE METHOD, AND HURST PROPORTIONAL COUNTER. Dale E. Hankins and Raymond A. Pederson (Los Alamos Scientific Lab., N. Mex.). July 1963. Contract W-7405-eng-36. 23p.

A comparison is made of the neutron dose rates obtained with the single-sphere neutron instrument, multisphere method, and Hurst proportional neutron counter, using PuBe and reactor-leakage neutrons. The PuBe source was placed inside metal shells of various materials and thicknesses, in paraffin, and at different depths in a tank of water about 2 ft square. Reactor-leakage neutrons from a shielded reactor and air-scattered neutrons from two unshielded assemblies were also used. The results were in good agreement for fast-neutron spectra; but for spectra consisting of low- and intermediate-energy neutrons, the Hurst proportional counter reported dose rates lower than the multisphere method by ~35 per cent, and the single-sphere instrument reported dose rates higher than the multisphere method by ~60 per cent. The results indicate that about 30 per cent of the total dose rate would be missed by using a Hurst proportional counter for reactor survey work, and that the single-sphere instrument can be used for all types of survey work by applying a correction factor to the indicated dose rate. (auth)

16300 (LAMS-3034(p.143-51)) HUMCO II: STATUS REPORT. P. N. Dean and E. C. Anderson (Los Alamos Scientific Lab., N. Mex.).

The design and operation of the Humco II whole-body counting facility are discussed. Data are summarized from measurements of γ activity from ^{40}K and ^{137}Cs in 345 human subjects. (C.H.)

16301 (LAMS-3034(p.152-61)) ABSOLUTE CALIBRATION OF WHOLE-BODY GAMMA-RAY SPECTROMETER FOR POTASSIUM AND CESIUM^{137}. P. N. Dean and M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.).

The calibration of the Humco II whole-body γ spectrometer for ^{40}K and ^{137}Cs determinations in man is described. (C.H.)

16302 (LAMS-3034(p.162-7)) EVALUATION OF THE POTASSIUM^{40} CONTINUUM CONTRIBUTION TO THE CESIUM^{137} PHOTOPEAK IN A SODIUM IODIDE CRYSTAL SPECTROMETER. E. C. Anderson, P. N. Dean, and M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.).

Gamma spectra of 27 subjects were measured before and at various times up to 5 hr after the intravenous injection of tracer amounts of ^{42}K. The results were used to calculate the ^{40}K contribution to the ^{137}Cs photopeak in a NaI crystal spectrometer. (C.H.)

16303 (LAMS-3034(p.205-23)) THERMOLUMINESCENT DOSIMETRY WITH ACTIVATED LITHIUM FLUORIDE. P. N. Dean and J. H. Larkins (Los Alamos Scientific Lab., N. Mex.).

The development of a LiF thermoluminescent dosimeter and thermoluminescence reader for use in radiobiology studies is described. (C.H.)

16304 (NP-13693) USTANOVKA DLYA IZMERENIYA UGLOVOGO RASPREDELENIYA ANNIGILYATSIONNOGO IZLUCHENIYA POZITRONOV V KONDENSIROVANNYKH SREDAKH. (Apparatus for Measuring the Angular Distribution of Annihilation Radiation of Positrons in Condensed Media). V. F. Antipov, B. G. Egiazarov, V. A. Zyubko, and O. A. Karpukhin (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 5p.

An installation consisting of 16 pairs of coincidence counters distributed at various angles and capable of measuring angular distributions is described. The device was designed for operation with Na^{22} and Cu^{64} positron emitters. (R.V.J.)

16305 (NP-13748) ENERGY- AND RATE-DEPENDENCE STUDIES. Final Report. R. K. Durkee, A. C. Lucas, N. B. York, T. S. Dahlstrom, and G. E. Blair (Edgerton, Germeshausen and Grier, Inc., Santa Barbara,

Calif.). [1961]. Contract DA-49-186-ORD-1059. 148p. (S-237-R)

Dosimeter systems of silver-activated phosphate glass rods, cobalt glass plates, and manganese-activated calcium fluoride were evaluated for their response to gamma rays, electrons, and neutrons. Response to gamma rays in the energy region from 0.022 to 15 Mev, rate dependence from 10 r/sec to 10^7 r/sec (in excess of 10^8 r/sec using 10 Mev electrons), and neutron sensitivity for fast and thermal neutrons were measured. Energy discriminatory shields and thermal neutron attenuation shields were designed, fabricated, and evaluated for each dosimetry system. (auth)

16306 (SGAE-PH-3/1964) RESOLUTION CORRECTION FOR AN IDEAL MAGNETIC BETA-SPECTROMETER. Helmut Paul (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Vienna). [1964]. 16p.

An ideal spectrometer is defined as one free of scattering, in which the shape of the magnetic field is independent of the absolute magnitude of the field. For such a spectrometer, general properties of the response function are derived, and a resolution correction is introduced which leaves the area under the spectrum constant. By introducing a definition of the shape factor which differs slightly from the conventional, it is shown that the resolution correction can be rigorously expressed as a factor multiplying the measured counting rate. This correction factor is given as an integral and contains no experimental quantities except the shape of the response function and the spectrum end point. By expanding the theoretical spectrum into a Taylor series and representing the response function by its moments about the calibration point, a series representation of the correction factor is obtained which is valid under very wide conditions. Applying this series representation to the special cases of Gaussian and exponential transmission curves, approximations which differ from those given by Owen are obtained. (auth)

16307 (TID-7689(p.31-3)) A LIGHT FILTER FOR REDUCTION OF BACKGROUND IN LIQUID SCINTILLATION COUNTING. Howard A. Swartz (Butler Univ., Indianapolis. Coll. of Pharmacy).

The reduction of the phosphorescence contribution to background in liquid scintillation counting was obtained by means of a glass light filter, which transmits in the 2500 to 4000 Å range. (M.C.G.)

16308 (TID-7689(p.103-5)) A UNIQUE SCINTILLATOR FOR NEUTRON DETECTION. H. H. Ross and R. E. Yerick (Oak Ridge National Lab., Tenn.).

The liquid scintillation technique for neutron detection using a liquid scintillator of ^{6}Li salicylate is described. Advantages of this material are discussed. (M.C.G.)

16309 (USNRDL-TR-701) REQUIREMENTS FOR MILITARY RADIACS. 2. EFFECT OF THE OPERATOR ON THE ENERGY-DIRECTIONAL RESPONSE OF PORTABLE RADIATION INSTRUMENTS. H. R. Wasson and D. H. Williams (Naval Radiological Defense Lab., San Francisco). Dec. 16, 1963. 67p. (AD-431548)

Results are presented of experiments designed to determine the response of selected military high-range radiacs to extended gamma radiation fields with and without a phantom (simulated operator). The IM-125/PDR-43, IM-153/PD, IM-108A/PD, PDR-63 (USNRDL prototype), and DT-60 (XN-2)/PD were tested with point sources of radiation with energies of 70, 120, 180 kev (eff), 667 kev (^{137}Cs), and 1170, 1330 kev (^{60}Co) at radiation intensities in the range 1 to 5 r/hr. Assuming that response of these radiacs to extended-field radiation sources can be inferred from their response to multilateral point sources at specific angles of elevation and over 360 deg of arc, it was found that response to radiation back-scattered from the operator compensates for decrease in response due to body (operator's) attenuation to an extent determined by type of radiac, carrying mode, and radiation energy. The presence of the operator has little effect on the response of the IM-125/PDR-43. Extended-field response of the IM-153/PD, IM-108A/PD, PDR-63, and DT-60(XN-2)/PD are all substantially decreased by the presence of the operator in varying degree, dependent on radiac type and radiation energy. Using present calibration methods, the net effect of the operator is to cause all of radiacs tested, except the DT-60(XN-2)/PD, to indicate about 0.75 of the true free-field radiation dose rate or dose. When worn by an operator, the DT-60(XN-2)/PD indicates about 0.65 of the free-field dose. These results are probably typical of portable radiation detection instrument response to extended fission product fields when held by an operator. (auth)

16310 (SC-T-64-46) RECENT DEVELOPMENTS IN THE RAPID NUCLEAR ELECTRONICS (ROLE OF THE DIODE TUNNEL). Jacques Mey. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Nucleus (Paris), 4: 384-91(Sept.-Oct. 1963). 17p.

The more important functional and technological developments in particle detector circuitry since 1960 are reviewed, with particular emphasis on the tunnel diode. The characteristics and theory of tunnel diodes are summarized, and some specific applications of tunnel diodes are described. (D.C.W.)

16311 A DECIMAL PIP METHOD FOR CONTINUOUS RECORDING OF RAPIDLY CHANGING RADIOACTIVE COUNTING RATES. B. Danielson, K. J. Obrink, U. Sjostrand, and M. Waller (Univ. of Uppsala). Acta Soc. Med. Upsalien., 63: 29-32(1964).

In cases where the concentration of a radioactive isotope changes within very wide ranges and so quickly that a conventional rate meter cannot be used, a decimal pip method is recommended. It has the advantage of having a zero time constant. In the pip method a signal is produced every time an arbitrary number of counts is completed. This is easily obtained with all types of scalers. From a binary scaler every 2^n-th and from a decade one every 1, 2, or 5 times 10^n-th pulse can be recorded. The number of pips during a given time gives the counting rate during this time without any lag. The tedious procedure of counting the pips and other shortcomings of the conventional pip method were overcome by the method presented. In principle the method consists of two or more individual pip systems acting on the same recorder. In the experiments described, systems recorded every tenth, hundredth, and thousandth count respectively. The three systems differed, however, in output voltages which made it easy to distinguish them from each other. For example, when evenly displaced pulses from a frequency generator were fed into the scaler at the rate of 1000 cpm, every 10th count can be easily distinguished. If the counting rate during the next second should increase a 100-fold, only the 1000th counts would be detectable. Thus the method gives an accuracy comparable to that of a logarithmic rate meter. The electronic circuit is diagramed. (BBB)

16312 EQUIPMENT FOR CONTINUOUSLY RECORDING GAMMA RADIATION. Slavko Hanzel and France Bremsak. Avtomatika 3: No. 2, 80-2(1962).

A device is described for the continuous recording of γ

radiation in a nuclear pile or hot laboratories. The radiation detector is a halogen Geiger-Müller counter. At low radiation level (0.1–100 millirads/hour), it operates as a self-quenched counter, and with heavier radiation dosages (up to 10 rads per hour) as an ionization chamber. The electrical circuit uses transistors, and a signal device operates if the dosage exceeds a preset limit. (Referativnyy Zhurnal, otdel'nyy vypusk, No. 23, 1962)

16313 A BI-DIRECTIONAL DECADE COUNTER WITH ANTI-COINCIDENCE NETWORK AND DIGITAL DISPLAY. A. F. Tassinari. Electron. Eng., 36: 173-7(Mar. 1964).

A reversible counter, which consists, basically, of four self-gating, flip-flop binary divider stages in cascade, with the correct feedback to form a decade counter is described. An anti-coincidence network is included and semiconductor devices are used throughout. (auth)

16314 A LITHIUM DRIFTED SILICON SURFACE BARRIER DETECTOR WITH GUARD RING. L. Wang, M. R. Zatzick, F. P. Ziemba (Solid State Radiations, Inc., Los Angeles). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 314-18(Jan. 1964).

A semiconductor nuclear particle detector combining the best features of the lithium ion drift technique, the surface barrier method, and incorporating a guard ring structure is described. Detectors having sensitive depths up to 6 mm with essentially no entrance window were fabricated by this process and experimental data illustrating some of the properties and applications of these devices are presented. (auth)

16315 A MULTICRYSTAL GAMMA-RAY SPECTROMETER WITH TIME-OF-FLIGHT REJECTION OF NEUTRON-INDUCED BACKGROUND. R. J. Scroggs, W. Zobel, and F. C. Maienschein (Oak Ridge National Lab., Tenn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 365-73(Jan. 1964).

To improve the rejection of neutron-induced background in a multicrystal gamma-ray spectrometer, nanosecond circuitry was designed that exploits the difference in flight times of neutrons and gamma rays produced in a target bombarded with a pulsed beam of monoenergetic protons. This circuitry allows the spectrometer to be gated on for a time (nominally 7 nsec) equal to the pulse width of the proton beam. Only those gamma rays produced during the proton pulse are accepted for energy analysis. These gamma rays arrive at the detector in a time short compared with the flight time of any other secondary radiation produced during that same beam pulse. The system is used as a pair spectrometer for energies from 1.5 to 11 Mev, and as a total absorption spectrometer for energies below 2.5 Mev. The energies of the gamma rays produced by 160-Mev protons in targets of Be, C, H_2O, Al, Co, and Bi were measured. Spectral data were obtained and the results include determination of essentially all the gamma rays previously described plus several more at higher energies. The neutron rejection ratio of the spectrometer varied with targets and ranged from 59% for C to 77% for H_2O. (auth)

16316 HEAVY-PARTICLE PATH LENGTHS IN CYLINDERS: APPLICATION TO α-PARTICLE DETECTION AND DOSIMETRY. J. B. Williams and A. E. Fein (Massachusetts Inst. of Tech., Cambridge). Intern. J. Appl. Radiation Isotopes, 15: 115-25(Mar. 1964).

From solid-angle considerations general expressions are derived for the differential and integral distributions of heavy-particle path lengths in cylinders. Application was made to the detection, spectrometry, and dosimetry of α rays in cylindrical systems. Experimental comparison was made with proportional counter differential spectra. (auth)

16317 LIQUID SCINTILLATORS USING 1-METHYLNAPHTHALENE. G. Goldstein and W. S. Lyon (Oak Ridge National Lab., Tenn.). Intern. J. Appl. Radiation Isotopes, 15: 133-7(Mar. 1964).

Liquid scintillators containing 1-methylnaphthalene were prepared and their properties determined. After purification of the commercially available 1-methylnaphthalene by chromatography on an acidic grade of activated alumina, solutions containing 1 g/l POPOP have a relative pulse height (γ excitation) equal to conventional xylene- or toluene-based scintillators. Pulse height is proportional to the Compton recoil energy. Possible areas of application of 1-methylnaphthalene include its use in large-volume scintillators because of its high flash point (112°C) and density (1.02); as a secondary solvent in xylene and p-dioxane based scintillators; in studies of energy transfer processes; and to distinguish between particles of different kinds by the pulse-shape discrimination method. (auth)

16318 EFFECT OF COPPER SULFATE ON THE CERIC DOSIMETRY SYSTEM. F. J. Munoz and Milagros Miró (Puerto Rico Nuclear Center, Rio Piedras). Intern. J. Appl. Radiation Isotopes, 15: 159-63(Mar. 1964).

The effect of cupric ion (at 10^{-3}–10^{-1} M) on the ceric dosimeter (at 10^{-3} N Ce^{4+}) was studied in 0.8 N H_2SO_4, using triple-distilled water and ordinary distilled water. When the Cu^{2+} concentration was increased to 10^{-2} M, a reduction in the $G(-Ce^{4+})$ value was found using ordinary distilled water; this reduction also tends to stabilize the system since the same $G(-Ce^{4+})$ value and statistical deviation was found for both triple-distilled water and for ordinary distilled water in the presence of 0.1 M $CuSO_4$. An empirical correspondence between the reduction in the $G(-Ce^{4+})$ value and the increasing copper concentration was established for the triple-distilled water solutions. (auth)

16319 A PROTECTED RADIOACTIVE SOURCE FOR ELECTRON CAPTURE AND OTHER GAS CHROMATOGRAPHIC DETECTORS. N. L. Gregory (National Inst. for Medical Research, Holly Hill, Hampstead, London). J. Chromatog., 13: 26-32(Jan. 1964).

A technique is described for the construction of ionization detectors in which there is no contact between the radioactive source and compounds eluted from the chromatograph column. This has advantages in electron capture detectors where it makes the use of radioactive materials other than tritium convenient. Higher operating temperatures may therefore be used. It is also advantageous in situations where eluted compounds might otherwise lead to deterioration of the radioactive source. (P.C.H.)

16320 DETERMINATION OF THE INTENSITY OF LOW-ENERGY GAMMA TRANSITIONS BY EXTERNAL CONVERSION. J. Oms and P. Chedin (Faculté de Sciences, Grenoble, France and Centre d'Études Nucléaires, Grenoble, France). J. Phys. (Paris), 24: 922-3(Nov. 1963). (In French)

The use of a cylindrical geometry–source coating a cylinder surface and converter stretching along the cylinder axis–for external conversion studies in a flat β spectrometer is shown to minimize the absorption of γ rays in the source and, even at low energies, the influence of the photoelectron-distribution anisotropy. (auth)

16321 DEVICE FOR MULTIDIMENSIONAL ANALYSIS IN NUCLEAR PHYSICS. J. C. Brun and C. Victor (Faculté

des Sciences, Orsay, France). J. Phys. (Paris), 24: 954-5 (Nov. 1963). (In French)

A multidimensional analyzer having 10^6 channels, built around an IBM 1620 computer, has been constructed. This equipment analyzes correlated information coming from linear or digital detectors. The processing of the information is practically simultaneous with storage and gives this equipment great versatility. (auth)

16322 PROBLEMS POSED BY THE TREATMENT OF NUCLEAR PHYSICS DATA. THE FUNCTIONAL MULTIDIMENSIONAL ANALYZER S.P.N.B.E. (SACLAY). A. Pages, M. Avril, and R. Moreau (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 956-9(Nov. 1963). (In French)

A survey is given to show the different steps in a functional multidimensional analyzer design and construction. There are no difficulties in using it either in simple or in complex experiments, although the component number is rather important. The total unit and the standard digit code are described. Input and control of the analyzer can be varied according to the kind of experiment, such as by splitting it to adapt it to experiments of various storage degrees. (auth)

16323 CONSTRUCTION OF A TIME-OF-FLIGHT SPECTROMETER, USING THE ^{3}He PARTICLES ASSOCIATED WITH NEUTRONS IN THE REACTION D(d,n)^{3}He. Jean Kahane and Pierre Vergezac (College de France, Paris). J. Phys. (Paris), 24: 962-4(Nov. 1963). (In French)

The two associated particles of the (d,d) reaction, ^{3}He and neutron, are detected by a p-n silicon junction and a plastic scintillator respectively. The time interval between these two events is measured by a transistorized time-to-pulse-height converter, with an over-all resolution of 3 to 4 nsec. The linearity being from 0 to 50 nsec, this apparatus should be able to resolve different groups of inelastically scattered d–d neutrons. (auth)

16324 DISCRIMINATION OF PARTICLES IN ORGANIC SCINTILLATORS. G. Walter, A. Huck, J.-P. Trevetin, and A. Coche (Centre de Recherches Nucléaires, Strasbourg). J. Phys. (Paris), 24: 1017-20(Nov. 1963). (In French)

For stilbene, an investigation of the components of light emission has shown that discrimination is possible between protons (down to 1.5 Mev) and alphas. Differences in the responses of stilbene for protons and deuterons in the range 0.8 to 1.8 Mev have been observed. A plastic scintillator, giving better discrimination than other known plastics, has been elaborated. The measurement of energy spectra by these scintillators using a bi-dimensional multichannel analyzer is discussed. (auth)

16325 A DOUBLE-FOCUSING ELECTROSTATIC SPECTROMETER FOR LOW-ENERGY ELECTRONS. R. Moret, A. Juillard, and A. Moussa (Faculté des Sciences, Grenoble, France). J. Phys. (Paris), 24: 1020-3(Nov. 1963). (In French)

A spherical-condenser electrostatic spectrometer is described. First data obtained with the apparatus include internal conversion spectra of rare earths at low energies. (auth)

16326 DETECTING SUB-NUCLEAR PARTICLES. Nucl. Energy, 75-6(Mar. 1964).

Equipment and methods used for the detection of particles from ZGS experiments are discussed. Equipment discussed is the spark detector, photographic emulsion, cloud chamber, and the bubble chamber. The advantages and disadvantages of these pieces of equipment are described. (P.C.H.)

16327 TRACK SPARK CHAMBER WITH ISOTROPIC PROPERTIES IN A MAGNETIC FIELD. G. E. Chikovani, N. N. Roinishvili, and V. A. Mikhailov (Inst. of Physics, Tbilisi, Georgian SSR). Phys. Letters, 8: 262(Feb. 15, 1964).

A sterocophoto of a soft shower, generated by cosmic radiation, is presented to show the operation of a track spark chamber with isotropic properties in a magnetic field of 7000 oersted. (L.B.S.)

16328 CORONA DISCHARGE DETECTORS FOR SLOW NEUTRONS. (REVIEW). Yu. M. Tolchenov and V. G. Chaikovskii. Pribory i Tekhn. Eksperim., No. 6, 5-12 (Nov.-Dec. 1963). (In Russian)

A brief description of the working mechanisms and construction principles of corona discharge detectors for slow neutrons is given. Fundamental performance characteristics and electric circuitry of the detectors are discussed. (tr-auth)

16329 SCINTILLATION GAMMA SPECTROMETER WITH FAST NEUTRON DISCRIMINATION. V. N. Bochkarev and V. V. Nefedov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 23-8(Nov.-Dec. 1963). (In Russian)

The design and performance of a scintillation spectrometer with a stilbene monocrystal for investigating γ spectra in the presence of fast neutrons are discussed. Reduction of the spectrometer sensitivity for neutrons is attained by a device that uses the difference in the nature of scintillations produced by electrons and protons in stilbene. The application of the spectrometer for determining relative intensities and excitation cross sections of γ lines is discussed. The γ spectra of carbon and oxygen bombarded by 14-Mev neutrons were determined. New lines in the carbon spectra at 1.60, 1.84, and 2.38 Mev and lines in the oxygen spectra at 2.2 and 2.7 Mev were discovered. (tr-auth)

16330 CHERENKOV SPECTROMETER FOR MEASURING GAMMA ENERGY. M. N. Khachaturyan and V. S. Pantuev (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekhn. Eksperim., No. 6, 29-32(Nov.-Dec. 1963). (In Russian)

A Cherenkov detector with total absorption from lead glass for measuring the energy of γ quanta and electrons in the range of several Bev is described. The detector was calibrated with monoenergetic electrons in the energy range 0.5–3.0 Bev. In this range the detector pulse amplitude varies linearly with electron energy. The energy resolution for 1-Bev electrons was determined to be ~29%. (tr-auth)

16331 CALIBRATED MULTI-ANGLE MAGNETIC ANALYZER-MULTISPECTROGRAPH. V. F. Litbin and K. I. Zherebtsova (Leningrad State Univ.). Pribory i Tekhn. Eksperim., No. 6, 33-6(Nov.-Dec. 1963). (In Russian)

A method for calibrating a multispectrograph by means of well determined nuclear reactions is described. The method gives not only the energy calibration of each channel but also the accurate energy determination of the bombarding particle. (tr-auth)

16332 MAGNETIC BETA SPECTROGRAPH WITH WIDE FOCUS. V. Z. Goldberg and V. P. Rudakov. Pribory i Tekhn. Eksperim., No. 6, 36-7(Nov.-Dec. 1963). (In Russian)

A magnetic spectrometer with a uniform field was constructed for investigating the β spectra of short-lived isotopes. A β-particle beam with a wide energy range can be focused. The maximum field of the spectrometer H_{max} =

4 kgauss and $HR_{max} = 10^5$ gauss · cm, corresponding to an electron energy of 30 Mev. The dynamic range is about 15. Spectrometers of this type with a photographic plate as detector can be very effective for spectral analysis of heavy charged particles from nuclear reactions. (tr-auth)

16333 RECOVERY TIME OF WILSON CHAMBERS. Yu. S. Ivanov and V. M. Federov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 42-4(Nov.-Dec. 1963). (In Russian)

The time delay in Wilson chambers was measured at standard saturation pressure as a function of temperature. The possibility of reducing the response time of the chamber is indicated. (tr-auth)

16334 150-LITER WILSON CHAMBER. V. M. Federov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 44-5(Nov.-Dec. 1963). (In Russian)

A 150-liter Wilson chamber for studying mesons (μ) in cosmic showers is described. The chamber is easily constructed, and its performance is reliable. (tr-auth)

16335 INVESTIGATION OF ION DRIFT IN WILSON CHAMBER BY MEANS OF A SPARK CHAMBER. Yu. A. Eremenko, Yu. T. Lukin, A. M. Machekhin, and M. I. Pak (Inst. of Nuclear Physics, Academy of Sciences, Kazakh SSR). Pribory i Tekhn. Eksperim., No. 6, 46-7(Nov.-Dec. 1963). (In Russian)

An argon-filled spark chamber is used to investigate ion drift in a Wilson chamber. It is shown that in the limit of precision the formula, $Z_{(measured)} = Z_{(actual)} \times 1/(1+\alpha)$ (α = expansion ratio), enables one to accurately determine the correction for the depth coordinate (Z) of tracks in terms of ion drift. (tr-auth)

16336 SEMI-AUTOMATIC EQUIPMENT FOR PROCESSING BUBBLE CHAMBER PHOTOGRAPHS. L. M. Barkov, K. N. Mukhin, V. A. Suetin, and R. S. Shlyapnikov (Inst. of Atomic Energy, Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 48-52(Nov.-Dec. 1963). (In Russian)

Semi-automatic equipment for processing bubble chamber photographs that uses a method of corresponding spots is described. The equipment measures coordinates and parallax of corresponding points in two photographs and automatically records them on punched tape that is suitable for immediate input into a computer. (tr-auth)

16337 INVESTIGATION OF THE CHARACTERISTICS OF ARGON-FILLED SPARK CHAMBERS. M. I. Pak, Yu. A. Eremenko, Yu. T. Lukin, and A. Kh. Tsoi (Inst. of Nuclear Physics, Academy of Sciences, Kazakh SSR). Pribory i Tekhn. Eksperim., No. 6, 52-4(Nov.-Dec. 1963). (In Russian)

The counting characteristics of a spark chamber are investigated by means of a Wilson chamber. It is shown that the apparent increase in efficiency in the plateau region is caused by spark discharges not coming from particle tracks. Preliminary calculations are made on the amplitude of the high voltage pulses supplied in the spark gap. The relation between the diameter of the spark channel, the high voltage pulse amplitude, and the discharge capacity is investigated. (tr-auth)

16338 MEASUREMENT OF THE MASS DISTRIBUTIONS OF HEAVY FRAGMENTS BY MEANS OF A PULSE AMPLITUDE ANALYZER. T. A. Mostovaya, V. I. Mostovoi, A. A. Osochinikov, and A. P. Tsitovich. Pribory i Tekhn. Eksperim., No. 6, 55-60(Nov.-Dec. 1963). (In Russian)

Apparatus for measuring the ratio of two pulse amplitudes produced in an ionization chamber by fission fragments is described. The mass distribution of the fragments from U^{235} thermal fission was measured. A peak-to-trough ratio of ~320 ± 55 was obtained from the mass distribution curve. (tr-auth)

16339 DETERMINATION OF THE SCATTERING CONSTANT K_s IN NIKFI-R EMULSIONS FOR MEASURING THE DISPERSION ANGLE OF 9-Bev PROTON BEAMS. D. Bozoki and E. Gomboshi (Central Inst. of Physics, Hungarian Academy of Sciences, Budapest). Pribory i Tekhn. Eksperim., No. 6, 61-5(Nov.-Dec. 1963). (In Russian)

The measurement of the lateral angular distribution of a 9-Bev proton beam in NIKFI-R in two zones perpendicular to the direction of bombardment was described. The angular distributions, corrected for background, gave the normal distributions. The scattering coefficient K_s was found to be 34.3 ± 1.6. (tr-auth)

16340 SINGULARITIES IN MULTICHANNEL DETECTION DEVICES WITH INTERMEDIATE MEMORIES FOR IMPULSE REGION WORK. G. I. Zabiyakin and G. A. Ososkov (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekhn. Eksperim., No. 6, 73-7(Nov.-Dec. 1963). (In Russian)

The application of intermediate memories in detection devices with time and multichannel analyzers for impulse region work is considered. The capacity and speed of response of the memories are evaluated in relation to the entrance intensity of detected events and the duty-factor of the system. (tr-auth)

16341 AMPLITUDE CONVERTER WITH LOGARITHMIC CHARACTERISTICS. E. O. Agasyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Pribory i Tekhn. Eksperim., No. 6, 103-5(Nov.-Dec. 1963). (In Russian)

The stability of an amplitude converter with logarithmic characteristics intended for measuring pulse amplitudes from proportional counters is discussed. The use of a high stability discriminator with a low response threshold eliminated the use of an amplifier across the discriminator, and a relative precision of ±(0.4 ± 0.8)% was obtained for amplitude measurements over the ranges investigated. The intrinsic resolution time of the converter is ~20 msec. (tr-auth)

16342 SPECTROMETER FOR INVESTIGATING SPIN-LATTICE RELAXATION SPECTRA IN PARAMAGNETIC MATERIALS WITH 8 mm WAVES. N. A. Amenitskii, L. S. Kornienko, and A. I. Smirnov (Moscow State Univ.). Pribory i Tekhn. Eksperim., No. 6, 119-21(Nov.-Dec. 1963). (In Russian)

The design of a r-f spectrometer for investigating EPR spectra in paramagnetic materials and for determining spin-lattice relaxation time in the interval $1\text{-}10^6$ sec is presented. (tr-auth)

16343 PHOTOELECTRIC METHOD FOR SCANNING DOPPLER SHIFTS OF SPECTRAL LINES. E. M. Drobyshevskii (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 145-9(Nov.-Dec. 1963). (In Russian)

A tentative method for scanning the Doppler shift of spectral lines is described. The method permits greater accuracy than other methods and has a scanning rate independent of the motion of the luminescent object. The essence of the method consists of photoelectric detection and comparison of two light beams received obliquely to the spectral line division. The calibration method is de-

scribed. The method is examined experimentally by means of a rotating plasma. (tr-auth)

16344 ENERGY DEPENDENCE OF PROTON RANGE IN EMULSION NIKFI-Ya2. I. Khauzer (Central Inst. of Nuclear Physics, Dresden). Pribory i Tekhn. Eksperim., No. 6, 168-9(Nov.-Dec. 1963). (In Russian)

The distribution of proton ranges in emulsion NIKFI-Ya2 is illustrated for the energy E = 6.47 ± 0.16 Mev. Proton ranges are also given as a function of energy for E^2 = 6 to 200 Mev^2. The results are compared with the Ilford G2 emulsion. (C.E.S.)

16345 CONVERTER-SWITCH APPARATUS FOR PULSE EXTRACTION FROM GEIGER COUNTERS. V. S. Golub, P. T. Levkovskii, and P. D. Pavlenko. Pribory i Tekhn. Eksperim., No. 6, 171-2(Nov.-Dec. 1963). (In Russian)

A transistorized converter-switch apparatus for pulse extraction from Geiger counters is described. The apparatus has a duration time of 5 μsec with rectangular pulses and a resolution time of 20 μsec. (C.E.S.)

16346 POLARIZATION SELECTIVITY OF CESIUM OXIDE PHOTOCATHODES. V. P. Zrelov (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekhn. Eksperim., No. 6, 183(Nov.-Dec. 1963). (In Russian)

The polarization selectivity of a cesium oxide photocathode was measured in the range (4-14) × 10^3 Å and at incident angles less than 75°. The measurements were performed with the FEU-28 photomultiplier. (C.E.S.)

16347 SCINTILLATION BETA-SPECTROMETER. U. Saulite and J. Cudors. Radioktivn. Izlucheniya i Metody ikh Issled., Akad. Nauk Latv. SSR, Inst. Fiz., 123-34(1961).

A scintillation β-spectrometer with a double CsI(Tl) crystal is described. The apparatus consists of a crystal, photomultiplier, linear amplifier, single channel analyzer or multiple analyzer, conversion installation, and a mechanical integrator (counter). The crystal has the form of a plate of 19 × 9 × 2 mm. Graduation of the spectrometer is carried out with the isotopes Co^{60}, Cs^{137}, and Hg^{203}. A method of subtracting the background from the γ rays is described. Modifications of the single channel analyzer used with higher resolution are also described. The problem of the influence of random summation of pulses in β spectra is discussed. (Referativnyy Zhurnal, Khimiya, No. 17, 1962)

16348 EFFECT OF DISTORTIONS AND NOISE ON THE MEASURING OF COULOMB MULTISCATTERING IN NUCLEAR EMULSION AND ITS REMOVAL. Ching-ju Jên. Sci. Sinica (Peking), 13: 221-30(Feb. 1964). (In Russian)

The effect of emulsion distortion on measurements of Coulomb multiscattering is discussed, and criteria for choosing the length of the cells for various cases are given. An attempt is made to use a measuring method for small cells (center-of-mass method) to reduce the effect of noise in the high energy region, and satisfactory results are obtained. The method of highest difference of coordinates was combined with the method for small cells, and results in agreement with experiment were obtained. The method of highest difference of coordinates effectively removes distortion and may be used for measuring oblique tracks. (tr-auth)

16349 ON ERRORS DUE TO THE DEAD TIME OF COUNTERS WITH BACKGROUND PRESENT. A. M. Shenderovich (Inst. of Physics and Tech., Khar'kov). Ukr. Fiz. Zh., 8: 1313-22(1963). (In Ukrainian)

Expressions are obtained for the average relative number of errors of counters possessing dead time with various laws of change in time and various correlations between the intensity of the useful effect and the background. (auth)

16350 DEVICE FOR DETERMINING THE CENTER OF A γ-RAY BEAM. R. P. Meshcheryakov and B. M. Yakovlev. p.284-7 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

To determine the position of the beam center of the 25–30 Mev bremsstrahlung in betatrons, it is proposed to measure the induced activity in a radiator made of aluminum or lead. This measurement is carried out, while the betatron is in operation, with the aid of 4 counters arranged in two pairs opposite to one another, using for this purpose only the 3/4 of the magnetic field variation period, when no electron acceleration takes place. The pulses from the counters are fed to two comparison circuits utilizing in their output pointer microammeters. A drawback of the device resides in the strong effect of the background induced in the counters and its shield. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16351 THE MOBILITY OF POSITIVE IONS IN GEIGER DISCHARGES. W. Dansercoer, R. Boucique, and P. Mortier (Rijksuniversiteit, Ghent). p.313-15 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The mobility of the positive ion sheath in self quenching Geiger counters was determined from experimental dead time and recovery time data. Counters with various anode diameters were used. The gas fillings were rare gas–alcohol mixtures. At high overvoltages both methods give results in reasonable agreement. At low overvoltages there are some significant discrepancies. They are probably to be ascribed to the varying composition of the ion sheath in the course of its motion. The analysis of the k values, as obtained from recovery time data, allows Blanc's law about the mobility of positive ions in gas mixtures to be tested. Some assumptions were made to account for the observed deviations. (auth)

16352 NEUTRON SPECTROMETRY AT TROMBAY. P. K. Iyengar (Atomic Energy Establishment, Trombay, India). p.279-91 of "Crystallography and Crystal Perfection." London, Academic Press, 1963.

Several neutron spectrometers are in operation with Canada India Reactor. The neutron spectrometers have their own special characteristics compared to the conventional x-ray units, due to the smaller intensity of the neutron beam and the method of detection. Details of crystal spectrometers, especially those used for obtaining powder and single crystal data, are described with respect to their mechanical design and data collection. (auth)

16353 RADIONUCLIDE ANALYSIS OF GAMMA-RAY SPECTRA BY STEPWISE MULTIPLE REGRESSION. Robert H. Shumway (Public Health Service, Washington, D. C.). Environmental Health Series. Public Health Service Publication No. 999-R-5. 1963. 19p. Free(GPO).

A modification of the usual multiple regression method is described for use in analyzing a gross gamma spectrum from an unknown solution containing many radionuclides. It involves a stepwise multiple regression procedure that sequentially tests the effect of each radionuclide until the spectrum is resolved. The principal advantages over the "spectrum stripping" or conventional multiple regression are that the procedure: (a) requires no a priori assumptions about the radionuclide content of the solution, and (b)

utilizes the information in all of the channels simultaneously. (auth)

16354 HIGH SENSITIVITY COUNTING TECHNIQUES. D. E. Watt and D. Ramsden. A Pergamon Press Book. International Series of Monographs on Electronics and Instrumentation. Volume 20. New York, The Macmillan Company, 1964. 361p. $12.00.

The attainment of low backgrounds in radiation detectors with cosmic-ray and secondary effects considered is discussed, typical low-background laboratories are described. The measurement of weak alpha activities, carbon-14 beta counting, counting of soft radiation using internal sources, and beta counting of solid and liquid sources are discussed. Gamma-ray detection and whole-body counting are also discussed. 586 references. (R.E.U.)

16355 NEUTRON DOSIMETRY USING ACTIVATION TECHNIQUES. J. A. Dennis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.189-208 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (AERE-R-4277)

The use of activation techniques for the measurement of neutron dose in the context of criticality accidents is examined, and the conventions necessary for interpretation and making a dose estimate are explained. A personnel dosimeter is described which uses the $S^{32}(n,p)P^{32}$ reaction for the measurement of fast neutrons; the $Au^{197}(n,\gamma)Au^{198}$ + Cd reaction for intermediate-energy neutrons; the $Au^{197}(n,\gamma)Au^{198}$ reaction for thermal neutrons; and In both as an exposure indicator by the $In^{115}(n,\gamma)In^{116m}$ reaction and for the measurement of fast neutrons by the $In^{115}(n,n')In^{115m}$ reaction. A system of installed dosimeters to reinforce the personnel dosimeter measurements is briefly outlined. (auth)

16356 MEASUREMENT OF FAST NEUTRON FLUX BY THE ACTIVATION OF PHOSPHORUS AND SULPHUR. A. H. W. Aten, Jr., G. Samson, G. A. Brinkman, and J. W. Dalenberg (Foundation for Fundamental Research in Matter, Amsterdam). p.209-15 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

For protection purposes the measurement of neutron fluxes by activation has two advantages over the use of counters: in the first place, the method is equally satisfactory for both pulsed sources and continuous fluxes, and secondly, it is possible to distribute the material to be activated in a large number of places and to measure the induced activity only in those samples and at those times where the neutron flux is of interest. The reaction $S^{32}(n,p)P^{32}$ is often used for monitoring fast neutrons (with energies above +2.5 Mev) but if the S is counted as such, the minimum flux which can be detected is a large multiple of the maximum permissible flux. An interesting method for concentrating P^{32} in S by chemical treatment has been described, but it is not equally well suited for all types of measuring equipment. An alternative method, based on ammonium sulfate as a detector and concentration of P^{32} from the solution by chemical precipitation, is discussed. The same neutrons that are measured by the reaction $S^{32}(n,p)P^{32}$ can be observed by the process $P^{31}(n,p)Si^{31}$ For short irradiation times, the sensitivity of this method is higher than that based on the activation of S. Several methods for measuring Si^{31}, both with and without chemical concentration, are discussed and in this connection the realtive merits of the activation of P and of S for fast neutron monitoring are compared. (auth)

16357 FAST NEUTRON DOSIMETRY USING PROTON RECOIL EMULSIONS. G. Portal (Centre d'Études Nucléaires, Saclay, France). p.219-35 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

The main problems encountered in the mass employment of nuclear emulsion dosimeters are discussed, together with the methods selected for reconciling speed and accuracy in the analysis of the results. Special reference is made to the method adopted for speeding up the counting of tracks, by pre-selection of dosimeters with the aid of a microscope suitable for quick analysis. The difficulty encountered with combined γ and fast neutron irradiation and how this affects the limits of utilization of the dosimeter is described. The effect of fading on emulsions is eliminated in order to prolong the period during which reliable measurement can be taken is explained. (auth)

16358 CALIBRATION OF AN ABSOLUTE SPECTROMETRIC SYSTEM OF FISSION NEUTRONS BY NUCLEAR EMULSIONS. P. Amadesi, A. Cavallini, and O. Rimondi (Comitato Nazionale per l'Energie Nucleare, Bologna). p.237-51 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

Nuclear emulsions are calibrated to give absolute measurements of fission neutron spectra. The advantages of the system are the small dimensions of the detector, which do not appreciably distort the neutron flux, and a good energy definition. The number and length of tracks left by hydrogen nuclei submitted to elastic scattering (n,p) are counted and measured on the exposed emulsions. The neutron spectrum is deduced from the proton spectrum by reference to experimental data. At the same time, a device has been developed for measuring the activity of a RaD–Be neutron source with a margin of error of no more than a few percent. It consists in measuring the β activity of gold foil exposed to neutrons, which are emitted from the source and slowed down by water. In this way, the efficiency of the emulsions as detectors can be ascertained with remarkable accuracy. (auth)

16359 INDUCED GAMMA FADING IN NEUTRON FILMS. V. Mejdahl and C. R. McCarthy (Danish Atomic Energy Commission, Risö, Roskilde). p.253-67 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The application of nuclear emulsions in neutron dosimetry is limited by the difficulty of distinguishing proton tracks in the presence of a heavy γ background. It is possible, however, to reduce the γ blackening without seriously affecting the proton track density by treating the exposed film with oxidizing agents or with acids prior to development. The treatment causes a suppression of the latent image by oxidation of the free Ag atoms in the sensitivity center of the AgBr crystals. The dependence of the γ-density reduction and of proton track density on temperature, concentration of solutions and duration of treatment is investigated. (auth)

16360 PROGRESS IN THE AUTOMATION OF PHOTOGRAPHIC DOSIMETRY. D. H. Peirson (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). p.305-17 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (AERE-M-1188)

The automation of two aspects of the Personnel Dosimetry service at the Atomic Energy Research Establishment

is under active development: the counting of proton tracks in nuclear emulsions used to measure the dose from fast neutrons, and the measurement of densities in the multi-filter film holder and computation of doses. (auth)

16361 THERMOLUMINESCENCE METHODS IN PERSONNEL DOSIMETRY. J. H. Schulman, F. H. Attix, E. J. West, and J. Ginther (Naval Research Lab., Washington, D. C.). p.319-39 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

The principles of the thermoluminescence method of dosimetry are discussed, and early attempts to provide thermoluminescent personnel dosimeters are reviewed briefly. Attention is concentrated on the successful achievement of such a dosimeter embodying the $CaF_2(Mn)$ phosphor in an appropriate envelope, which gives a device that is linear in response from about $10^{-3} \times 10^5$ rad. The performance of this device with respect to range, linearity, rate independence, energy dependence, speed of reading and re-usability makes it an attractive replacement for the film badge in personnel monitoring. The dosimeter and automatized reading instrument developed for the U. S. Government under the auspices of the U. S. Navy Bureau of Ships is illustrated. Recent progress in the use of LiF as a thermoluminescent material is reviewed. New configurations of miniature dosimeters using $CaF_2(Mn)$ are described, and their performance is discussed. A method for obtaining repeated readings of dose from a single exposure of a thermoluminescent dosimeter is also described. (auth)

16362 MEASUREMENT OF FAST NEUTRON FLUX BY MEANS OF A NON-DIRECTIONAL COUNTER. M. Ladu P. Pelliccioni, and E. Rotondi (Comitato Nazionale per l'Energia Nucleare, Frascati, Italy). p.341-50 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

A fast-neutron detector has been developed by incorporating a BF_3 counter in a hollow spherical paraffin moderator. Its angular response is constant to within 2%. Its effectiveness with regard to neutrons from a Po–Be source is approximately 2.4 counts/n/cm^2/sec. The law of the inverse square of the distance is confirmed if the neutron flux is measured from the source to the geometrical center of the detection system, which means that the outfit can be regarded as a point detector. Given appropriate calibration, the detector can therefore also be used for determining the activity of neutron sources. (auth)

16363 RECENT ADVANCES IN PERSONNEL DOSIMETRY AT CHALK RIVER. G. Cowper (Atomic Energy of Canada, Ltd., Chalk River, Ont.). p.351-66 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

Developments in film dosimetry, including the design of a new film dosimeter, personnel warning dosimeters, various applications of pulse counters to the determination of radiation dose rate, the use of thin scintillator techniques for β dose, rate measurement and activation techniques for neutron dosimetry are described. The limitations of these various methods and their application to existing operating problems are discussed. (auth)

16364 OBSERVATIONS ON PROBLEMS OF β, γ, AND X-RAY PERSONNEL DOSIMETRY. H. Joffre (Centre d'Études Nucléaires, Saclay, France). p.371-91 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963. (In French)

After a review of the present state of knowledge with regard to the determination of the absorbed doses resulting from external irradiation by the various radiations, the relative sensitivity of conventional detectors is discussed. Criteria for selecting the sensitive medium, and the type and thickness of the detector wall are defined. The entire detection system for measuring the dose absorbed at a given point in the organism must be designed in such a way that the same overall interaction should occur with the type of radiation involved as that which occurs in the body itself. (auth)

16365 CAPABILITIES AND LIMITATIONS OF THE DIFFERENT METHODS APPLIED IN PERSONNEL DOSIMETRY. K. Becker (Jülich Nuclear Research Establishment, Ger.). p.393-412 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963.

Errors in determining the biological active whole-body, part-body or organ dose, including physical deviations of the dosimeter itself and those resulting from scattering, absorption and build-up effects of the human body, as well as errors resulting from irradiation of parts of the body on which dosimeters are not worn, are reviewed. Such physical failures are but of small importance compared with failures due to inaccurate knowledge of the space distribution of the irradiation in the case of β, neutron, and soft x rays. Relatively best known are the sometimes considerable failures of the photographic methods. The main sources of error are the energy dependence of the photographic emulsion for quantum radiation, the instability of the photographic film, i.e., the fading properties of nuclear track emulsions used in fast-neutron dosimetry, and the developing process. Chemical systems are too instable and too insensitive for practical use in routine personnel dosimetry. Thermoluminescent dosimeters are of high sensitivity and, in the case of LiF, of low energy dependence. But the radiation effect also fades relatively fast and they are not for use as an indication of radiation exposure. More recent radiophotoluminescent, silver-activated phosphate glasses with low pre-dose, used in suitable metal capsules for correction of the energy and directional dependence, are at the moment the best long-time dosimeters for integrating measurements of quantum radiation above 30 kev, β rays and thermal-epithermal neutrons. Fast-neutron determination with foil activation techniques is too insensitive for routine control; for the determination of neutron-induced body activity at least a simple body-counter arrangement is required. Irreversible changes in neutron-irradiated semi-conductors are of interest. Most of the self-reading pocket dosimeters are now suitable for measurements of quantum radiation between 30 kev and several Mev. However, larger or smaller doses may be simulated by directional dependence, self-discharge and mechanical shocks. Pocket dosimeters recording thermal neutrons are scarcely used in practice, while new fast-neutron self-reading systems would appear to be of little value for practical health physics purposes in nuclear establishments. Some other electrometric systems are of interest. (auth)

16366 SCINTILLATING PLASTICS. J. Halvas (Comisión Nacional de Energía Nuclear, Mexico City). 8p. (CONF-436-1) (In English and Spanish)

From 10th International Congress on Radiology, Montreal, Aug.-Sept. 1962.

Characteristics of the plastic used and its reaction to gamma radiation as well as the criterion on which the design and construction of the apparatus are based, are presented. Elements of the transductor system, the circuit employed as well as the sweeping unit and signal recording are described. Tracings obtained and the interpretation and comparison with other systems are presented. The advantages of the device are pointed out, mainly in that isodose distribution in terms of rads can be rapidly ascertained. (auth)

16367 A SUGGESTED STANDARD METHOD TO EVALUATE EFFECTIVE THRESHOLD FOIL PARAMETERS. Barry Fairand and Harold Epstein (Battelle Memorial Inst., Columbus, Ohio). 20p. (CONF-187-105)

From American Nuclear Society Meeting, New York, Nov. 1963.

A standard procedure for determining the threshold foil parameters by a fission flux-weighted, least-squares averaging technique is presented for the Trice method of measuring fast-neutron integral spectra. Although most of the effective threshold and cross sections obtained by the proposed technique do not differ greatly from some of the values commonly in use, the advantage is that they do not reflect individual judgments of the investigator who obtains them. (auth)

16368 RADIATION DOSIMETER. Frank Edward Hoecker and Homer Leonard Hiebert. British Patent 951,647. Mar. 11, 1964. Filed Aug. 20, 1960.

A simple, inexpensive dosimeter was designed for indicating when a material under treatment has been exposed to a predetermined amount of radiation and/or when an accumulated dose has been reached. The dosimeter comprises a transparent capsule containing a liquid monomer which is transformed into a solid polymer upon exposure to a certain radiation dose, and a movable means, e.g., a ball, in the capsule for indicating the physical state of the monomer/polymer. An inhibiting agent such as iodine may be added to the monomer to vary its sensitivity to radiation. (D.L.C.)

16369 NUCLEAR RADIATION INDICATING SYSTEMS. (to Republic Steel Corp.). British Patent 951,966. Mar. 11, 1964. Priority date July 27, 1960, United States.

A radiation detection system using Geiger tubes is designed for indicating radiations at a point remote from the point of radiation detection. The system is particularly useful for level indication in the operation of metallurgical furnaces, e.g. in conjunction with the gaging system described in British Patent 894,352. The system comprises a circuit of sturdy construction and improved reliability (no vacuum tubes other than the Geiger tube) for the transmission of the signal to a distant point through a low-impedance circuit. A modified system using high a-c voltage in place of d-c and a Geiger tube for use with the modified system are described. (D.L.C.)

16370 IMPROVEMENTS IN IONIZATION CHAMBERS. Philip Edwin Ohmart (to Ohmart Corp.). British Patent 952,604. Mar. 18, 1964. Filed Mar. 28, 1960.

An ionization chamber that is deliberately arranged to operate at an ion-collection efficiency below 85% is described. It is adapted for used in control or measuring devices and is effective to conduct a current substantially free from random fluctuations so that the current always represents an accurate indication of a variable condition being measured. A method of testing a variable condition is provided, wherein ionizing radiation impinges on an ionization chamber and the instantaneous value of the condition being tested determines the amount of radiation impinging on the chamber at that instant. (M.C.G.)

16371 THERMAL NEUTRON MEASURING DEVICE FOR MEASURING REACTOR POWER. Angus Charles Whittier (to Atomic Energy of Canada Ltd.). U. S. Patent 3,126,481. Mar. 24, 1964. Filed Apr. 15, 1960.

An apparatus for detecting thermal neutrons as a measure of reactor power is designed which is insensitive to gamma rays and fast neutrons. The apparatus comprises a path for the radiation from the reactor core, and a thin hydrogenous scattering substance in the path to scatter thermal neutrons to the detector. The detector is positioned relative to the scatterer so that it receives only the scattered thermal neutrons. The scatterer may be formed of two pieces of polystyrene shaped in a V at 90° to each other. (D.L.C.)

16372 RADIO-ACTIVITY CONTAMINATION MONITOR WITH DISCRIMINATION MEANS FOR ALPHA AND BETA RADIATION. James Robert Brown and Jack Sharpe (to Electric and Musical Industries Ltd.). U. S. Patent 3,126,482. Mar. 24, 1964. Priority date Oct. 6, 1959, Great Britain.

A radioactive contamination monitor is designed which responds to α and β radiations and has means for producing audibly distinguishable signals in response respectively to said α and β radiations. The monitor includes a dual phosphor scintillation probe which produces pulse in one amplitude range in response to α rays and pulses in another amplitude range in response to β rays, means for producing a pulse in a first channel in response to pulses in both amplitude ranges and a pulse in a second channel in response only to pulses in one range, an anticoincidence circuit, a tone circuit, and a sound transducer. (D.L.C.)

16373 COMBINATION RADIATION DETECTOR AND AMPLIFIER. Kay M. Hoalst (to Hughes Aircraft Co.). U. S. Patent 3,126,483. Mar. 24, 1964. Filed Nov. 22, 1960.

A semiconductor detector device in combination with an amplifier is designed in order to reduce noise pickup. The device has a relatively thick intrinsic particle-radiation-energy-receiving zone under electrical bias, two conductivity type boundary zones forming opposed bounds of the intrinsic zone, ohmic contacts to each of the boundary zones for applying bias thereto, and rectifying contacts to one of the opposed zones coupled to an amplifier circuit to amplify the pulses induced in the intrinsic zone before they leave the crystal. (D.L.C.)

16374 SCINTILLATION MEASURING HEAD. Rudolf Raykhel and Gyunter Zakse. Russian Patent 155568.

A scintillation measuring head for dosimetric control of liquids is described. The scintillator can be either a plastic or an organic liquid. To ensure continuous control, the plastic scintillator is designed as a hollow cylinder through which the controlled liquid passes in a continuous flow. To improve sensitivity, the cylinder contains a number of rods, walls, or smaller cylinders made of identical materials and bonded by means of a special glue which ensures optical transparency. The controlled liquid flows around these rods or walls. To improve the measurement sensitivity of the organic liquid scintillator, a vessel is used which is designed in the shape of a completely closed cylindrical body containing additional cylinders. The latter, which may

be made of quartz glass, are connected by bypass apertures, and the space between them is filled with the organic liquid scintillator. The investigated liquid flows in cylinders through a spiral. (auth)

16375 LIQUID SCINTILLATOR. L. M. Kutsyna. Russian Patent 155881.

A liquid scintillator intended for use in medical radiology and dosimetry, biology, and physics as an air-, water-, or tissue-equivalent scintillator is described. To improve efficiency and reduce volatility, the scintillator contains tributyl phosphate, methylnaphthalene, and a 2.5-diphenyloxazole activator. (auth)

ISOTOPE TECHNOLOGY

General

16376 (MLM-1157) MOUND LABORATORY PROGRESS REPORT FOR MAY 1963. J. F. Eichelberger, G. R. Grove, L. V. Jones, and E. A. Rembold (Mound Lab., Miamisburg, Ohio). May 31, 1963. Contract AT(33-1)-Gen-53. 19p.

Progress is reported on research directed toward: the development of adhesives, which are compatible with explosives; the measurement of nuclear properties of polonium isotopes; residue adsorption; separation and purification of isotopes; thermal diffusion theory analyses; emission strength analyses for neutron sources; and krypton-85 counting methods development. (B.O.G.)

16377 (ORNL-TM-515) FISSION PRODUCTS. Progress Report, October–November 1962. R. E. McHenry, comp. (Oak Ridge National Lab., Tenn.). Apr. 9, 1963. Contract [W-7405-eng-26]. 12p.

Progress is reported on developments in the treatment of Purex waste solutions, the extraction of ruthenium from nitric acid solutions using TBP, the calibration and performance analysis of gamma-source calorimeters, and the adsorption of iodine-131 from aqueous solutions. (B.O.G.)

16378 (TID-7689) SECOND ANNUAL OAK RIDGE RADIOISOTOPE CONFERENCE, APRIL 19-22, 1964. (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn. and Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26. 151p.

Thirty-nine papers and an abstract of one paper presented at the Second Annual Oak Ridge Radioisotope Conference are given. Separate abstracts were prepared for 37 papers. One paper was previously abstracted for NSA as 18: 13377. Progress on the Isotopes Information Center at ORNL is reported in the remaining paper. (M.C.G.)

For abstracts of individual papers see: 15746, 15747, 15748, 15757, 15781, 15782, 15783, 15784, 15785, 15905, 15913, 15914, 15915, 15916, 15917, 15918, 15962, 15999, 16000, 16001, 16002, 16003, 16067, 16078, 16165, 16192, 16193, 16194, 16195, 16231, 16307, 16308, 16397, 16400, 16456, 16479, and 16650.

16379 A SURVEY OF PHOTONEUTRON SOURCES. Pentti Kauranen and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Radiochim. Acta, 2: 96-9(Dec. 1963).

A study was made of the potential applicability of different gamma emitters for (γ,n) neutron sources. Some experimental data on the preparation of such sources are reported, and the neutron fluxes obtained with experimental sources are given. A table of high energy gamma emitters ($E\gamma > 1.66$ Mev) obtainable by activation in a nuclear reactor is also given. (auth)

16380 RADIONUCLIDE. 2. AUFLAGE. (Radionuclides. 2nd Edition). Kurt Schmeiser. Berlin, Springer-Verlag, 1963. 293p.

The rapid development of the use of radioisotopes in chemistry, biology, medicine, geology, mineralogy, industry, and other areas has necessitated a wide knowledge of detection methods for radiations and their experimental control. The principles necessary for such work are compiled. A brief survey is first given of atomic structure and the method for the production of radioisotopes. The interaction of α, β, and γ radiation with matter is described. The principal radiation-detection instruments–ionization chambers, electroscopes, proportional counters, G-M counters, and scintillation counters–are considered. The characteristics of radioactive decay and the accuracy of measurements of the decay are reviewed. A detailed discussion is presented on the methods for the detection of radiation. In conclusion, some examples of the use of radioisotopes and production precautions are discussed. (J.S.R.)

Industrial Applications

16381 (NP-13619) IZMENENIE OKISLITEL'NO-VOSSTANOVITEL'NYKH SVOISTV MYASA PRI OBLUCHENII Co^{60}. (Changes in the Oxygen Reduction Properties of Meat by Means of Irradiation with Co^{60}). V. V. Pal'min (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 16p.

The reducing power of albumless meat extract increases with an increased γ irradiation of the meat in oxygen-free media. Such changes are related to the accumulation of reducing carbohydrates. An artificial increase of pH depresses the reducing power of the extract. The reducing power of high pH meat extract improves under irradiation but does not reach the level reached with constant pH. Irradiation of meat under aerobic conditions results in more intense oxygen reduction and accumulation of products with oxidizing properties. Hence, the oxygen reduction potential in meat irradiated under aerobic conditions is higher. (R.V.J.)

16382 (TID-7688) OAK RIDGE RADIOISOTOPE CONFERENCE. RESEARCH APPLICATIONS TO PHYSICAL SCIENCE AND ENGINEERING, APRIL 1-3, 1963. (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn. and Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26. 120p.

A total of 28 papers was presented on various radioisotope applications in engineering, physical science, and research. These applications include gaging applications, analysis, tracer applications, leak detection, power applications, etc. Separate abstracts were prepared for 17 of the papers; 10 of the remaining papers were previously abstracted in NSA. (D.L.C.)

For abstracts of individual papers see: 15961, 15998, 16230, 16383, 16384, 16385, 16386, 16387, 16388, 16389, 16390, 16391, 16392, 16393, 16399, 16478, and 16550.

16383 (TID-7688(p.7-13)) AN ALPHA GAUGE SYSTEM FOR THE CONTINUOUS MEASUREMENT OF GAS DENSITY, GAS PRESSURE, AND THIN FILM THICKNESS. H. H. Ross and R. P. Gardner (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.).

A new alpha-particle gage was developed based on a transmission, total-count principle. The gage includes a Au–Si surface barrier detector, a thick alpha source, and a wide band-pass transistorized ratemeter. The gage is free from the complicated electronic and mechanical equipment of other alpha gage systems. Its performance was tested using pure gases and $He-O_2$ mixtures. (D.L.C.)

16384 (TID-7688(p.31-7)) A RADIOMETRIC DETERMINATION OF AN ADSORPTION ISOTHERM OF A SUR-

FACTANT ON AN ORGANIC SUBSTRATE. J. Haberman and T. C. Castorina (Picatinny Arsenal, Dover, N. J.).

Carbon-14-tagged trimethyl stearyl ammonium bromide (STAB) was used to study the adsorption of STAB from 10% EtOH on cyclotetramethylene tetranitramine (HMX). The problems of STAB sorption on glass and micelle formation are discussed. The resulting isotherm is of the Langmuir type, with the plateau region of the curve at 0.3 mg STAB/g HMX. The reversibility of the adsorption was established by desorption experiments. It is concluded that this radiometric method is a sensitive tool for studying surfaces having very low residual energies. (D.L.C.)

16385 (TID-7688(p.38-40)) THE APPLICATION OF RADIOCHEMISTRY TO SEMICONDUCTOR RESEARCH. G. B. Larrabee (Texas Instruments, Inc., Dallas).

The importance of minute amounts of impurities in semiconductors requires the use of radioactive tracers for study of problems that arise in the manufacture of semiconductors and devices. To illustrate the use, the fabrication of a silicon diode is considered. Tracers were used to study the manufacture of elemental Si, surface contamination, and diffusion of a doping impurity. (D.L.C.)

16386 (TID-7688(p.40-3)) STUDY OF THE VACUUM DISTILLATION PHENOMENA AND THIN FILM DEPOSITION WITH THE RADIOACTIVE TRACER. L. E. Preuss and C. Bugenis (Henry Ford Hospital. Edsel B. Ford Inst. for Medical Research, Detroit).

An investigation of some of the mechanics of the distillation process was made using Cr^{51}, Au^{198}, W^{185}, and other tracers. Experimental condensate and profiles were determined and compared with theoretical profiles. Binary distillation of Au and W was studied. (D.L.C.)

16387 (TID-7688(p.76-8)) PROCESS GAS FLOW RATE MEASUREMENTS WITH RADIOACTIVE XENON-133. Royal H. Benson and Robert L. Maute (Monsanto Chemical Co., Texas City, Tex.).

Xe^{133} was used in a tracer method to measure gas flow rates in process lines containing corrosive material and entrained particulate matter. The injection equipment and sampling procedure are described, and the activity of Xe^{133} in gas samples is measured by coincidence scintillation counting. The method was used successfully to measure gas flows from 50 to 50,000 l/min with a standard deviation of less than ±1%. (D.L.C.)

16388 (TID-7688(p.78-80)) DEVELOPMENT OF A RADIOCHEMICAL PROCEDURE FOR THE DETERMINATION OF FILTER EFFICIENCY IN THE REMOVAL OF OIL MIST FROM COMPRESSED AIR. R. A. Ewing, R. B. Price, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio).

A tracer method was developed for testing the performance of high-efficiency filters for the removal of oil mist from compressed air. The method comprises adding tritium-tagged dioctyl phthalate to the lubricating oil of a compressor, passing samples of the air stream from before and after the filter under test through absolute filters, recovering the oil from these absolute filters, and analyzing it by liquid scintillation counting. Filter efficiencies in the 99+% range can be determined and oil carryover rates in filtered air of milligrams/day measured. The problems encountered with tritium-tagged n-octadecane, the first tracer investigated, are discussed. (D.L.C.)

16389 (TID-7688(p.80-3)) LEAK TESTING IN PETROLEUM REFINERIES WITH RADIOISOTOPES. B. A. Fries (California Research Corp., Richmond).

Leaks in heat exchangers nearly always create operating difficulties and result in loss or contamination of products. Isotope engineering techniques are used to detect and measure such leaks without disturbing the operation of the equipment. Two examples of this use in a petroleum refinery are given here. In one, a gas leak in the reboiler of a stripping column was found using Kr^{85}; in the other, a salt water leak in the overhead condenser of a distillation column was found using tritiated water. (auth)

16390 (TID-7688(p.84-90)) RADIOTRACER ANALYSIS OF CATALYST FLOW DISTRIBUTION. D. E. Hull (California Research Corp., Richmond) and F. F. Ball (California Oil Co. Salt Lake Refinery, Utah).

A radiotracer study was made of the catalyst flow through a lower seal leg in which several internal baffle plates were warped, in a petroleum cracking plant. Radioactive ^{134}Cs-containing catalyst beads and Geiger counters were used in the study. The results indicated considerable flow plugging. (D.L.C.)

16391 (TID-7688(p.91-4)) SINGLE-SAMPLE RADIOTRACER TECHNIQUE FOR DETERMINING STREAM FLOW RATES. R. P. Gardner and J. W. Dunn, III (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.).

A tracer technique for measuring stream flow rates in open-channel streams with small, irregular cross-sectional areas, was devised which allows easy calibration. The technique comprises continuous counting in the stream and taking a single sample while the tracer is passing. The relationship between the in situ counting rates and the sample concentration makes it possible to cancel out the in situ counting calibration, and the stream flow rate is easily calculated. (D.L.C.)

16392 (TID-7688(p.95-7)) LARGE SCALE USE OF RADIOTRACERS FOR LEAK DETECTION IN THE SATURN SPACE VEHICLE. G. L. Gyorey, L. E. Brownell, and M. York (Michigan. Univ., Ann Arbor).

The methods used in the leak testing of the Saturn vehicle are described. A study was made of the possible use of a radiotracer for leak detection when the vehicle is fueled or in flight. ^{85}Kr was selected as the tracer, and results of a few preliminary tests are given. The difficulties of detecting the beta rays of ^{85}Kr in the presence of a gamma background are discussed. It is concluded that a leak detection sensitivity of 10^{-4} cc/sec can be achieved with low gamma background conditions using a ^{85}Kr concentration of 1 μC/cc. The advantages of this tracer method over other methods are described. (D.L.C.)

16393 (TID-7688(p.106-13)) SILAGE DENSITY MEASURED BY GAMMA ENERGY ATTENUATION. P. E. James and D. E. Wilkins (Department of Agriculture. Agricultural Research Service, Beltsville, Md.).

A method was needed to measure the density of silage within the silo. The gamma ray attenuation method was chosen; in this method, a rabbit containing a ^{137}Cs source is lowered through a pipe mounted in the center of the silo, and a crystal detector is synchronized to run down outside the silo at the same speed as the rabbit. Some results of studies of silage employing this method are reported. (D.L.C.)

16394 APPARATUS FOR CONTINUOUS ABRASION CONTROL USING RADIOISOTOPES. Zbigniew Banasik. Krajowe Symp. Zastosowan Izotopow Tech., 1-sze Rogow, Pol., No. 46, 1961. (In Polish)

The content of abrasion products from the moving parts of an Amsler machine, labeled with Co^{60}, was determined in the machine oil from the radioactivity using a scintillation counter. The efficiency of the apparatus is 11% at a γ-quantum energy of >1 Mev. (Referativnyy Zhurnal, Khimiya, No. 22, 1962)

16395 MEASUREMENT OF VACUUM BY MEANS OF RADIOACTIVE PREPARATIONS. V. S. Kirsanov (All-Union Instrument Research Inst., Academy of Sciences, USSR). Pribory i Tekhn. Eksperim., No. 6, 182(Nov.-Dec. 1963). (In Russian)

A device for measuring a vacuum that consists of a radioactive preparation containing a β emitter, a collector, a high electric resistor, and a voltmeter is described. The electrons ionize the molecules in the vacuum. Since the ion current is dependent upon pressure the voltmeter reading is a function of the pressure. (C.E.S.)

16396 A DEVICE FOR MEASURING THE THICKNESS OF MATERIALS BY THE ABSORPTION OF BETA-RAYS. Werner Hartman (Khartman) and Karl-Heinz Weber. Russian Patent 149,231. May 27, 1960.

Description is given of a device for measuring the thickness of materials by the absorption of beta rays. It uses an absorber and differs in that, to increase the accuracy of the measurements, the windows of the chamber of the device have round holes that ensure that the measured value does not depend on distance and that can be partially covered by known absorbers if a collimated straight light beam is used. (TCO)

Power Application

16397 (TID-7689(p.72-6)) A RADIOISOTOPE-POWERED UNDERWATER ACOUSTIC BEACON. Marvin P. Norin (Martin-Marietta Corp. Aerospace Div., Baltimore).

An acoustic beacon, powered by radioisotopes, to provide a fixed reference point navigation aid is being developed. The energy produced by decay of a radioisotope is converted to acoustic energy by thermal-fluid-mechanical means. The acoustic energy is in the form of 5000 cpp signals of 20 to 30 msec durations at intervals of 20 to 30 sec. The signals are omnidirectional and have a range of 20 miles or better. With ^{90}Sr fuel the device has a design life of a minimum of 5 years. (M.C.G.)

Separation and Production

Refer also to abstract 16413.

16398 (JAERI-4027) METHODS OF PRODUCTION OF PHOSPHORUS-32, SULFUR-35 AND IODINE-131. Nagao Shibata and Eiji Shikata (Japan Atomic Energy Research Inst., Tokyo). Nov. 1963. 16p.

A review is presented of methods of production of phosphorus-32, sulfur-35 and iodine-131 which have been developed in many countries. In addition to this review, the method of production of each radioisotope adopted in Japan and the present status of the production are described. (auth)

16399 (TID-7688(p.5-7)) THE OAK RIDGE NATIONAL LABORATORY 86-INCH CYCLOTRON PROGRAM. J. J. Pinajian (Oak Ridge National Lab., Tenn.).

The ORNL cyclotron with 22-Mev proton beams is the primary source of carrier-free neutron-deficient radioisotopes. The available target types and proton irradiation facilities are described. The program for the development of targets and production techniques is described. Finally, some of the more commonly produced radionuclides are listed. (D.L.C.)

16400 (TID-7689(p.89-93)) RECYCLE GAS CHROMATOGRAPHY: SEPARATION OF ISOTOPIC MOLECULES. John W. Root, Edward K. C. Lee, and F. S. Rowland (Kansas. Univ., Lawrence).

A recycling technique in gas chromatography for extending column length almost indefinitely was developed. It proved to be applicable for separations of isotopic molecules or for resolution of other molecular pairs that are difficult to separate on the usual columns. The system operates with two identical columns in series with a recorder in between. The columns are connected with 4-way stopcocks for rapid reversal of the sequence of the columns in the series, and an additional recorder is provided at the system exit. After injection of a mixture of isotopic molecules, the system is then cycled indefinitely by alternating the column sequence until the isotopic molecules have distinctly different retention volumes, as shown by separated peaks, or have broadened too much to be of further use. Figures for the separation of CH_4 and CO_4 are shown. Extensive recycling failed to separate ^{20}Ne and ^{22}Ne or ^{36}Ar and ^{40}Ar, demonstrating that the separations are not achieved on a mass basis. The experimental results to date can be correlated well with the polarizabilities of the isotopic species. This correlation indicated that isotopic pairs with appreciable polarizability differences can be separated by this technique. (M.C.G.)

16401 (ZFK-RCH-1) DIE TECHNOLGIE DER ISOTOPENPRODUKTION. TEIL I. BESTRAHLUNGS-TECHNOLOGIE. (The Technology of Isotope Production. Part I. Irradiation Technology). Peter Knoll (Germany. Zentralinstitut für Kernphysik, Dresden). Dec. 1961. 93p.

Irradiation methods for the preparation of radioisotopes are discussed. Irradiation facilities and radiochemical laboratory equipment are described. The production progress, production documentation, target standardization, and selection of packing material for targets are discussed. Results of activity calculations and measurements for (n,γ), (n,p), (n,α), and (n,2n) reactions are presented. (M.C.G.)

16402 ISOTOPIC EXCHANGE OF IRON BETWEEN IRON CHLORIDE AND IRON CUPFERRATE. A. Arroyo, M. Casabianca, M. Cendales, and S. J. Nassiff (Instituto de Asuntos Nucleares, Bogota, Colombia). Intern. J. Appl. Radiation Isotopes, 15: 107-10(Mar. 1964).

Half times of iron exchange in a homogeneous phase between iron cupferrate and iron chloride were measured. The experiments were accomplished in chloroform at temperatures ranging between 0 and −35°C. (auth)

16403 INVESTIGATION OF ISOTOPIC EFFECTS IN THE REDUCTION OF NITRIC ACID TO NITRIC OXIDES IN THE PRESENCE OF MERCURY. I. A. Tikhomirov and A. P. Vergun (Tomsk Polytechnic Inst., USSR). Izv. Sibirsk. Otd. Akad. Nauk SSSR, No. 3, 154-6(1963). (In Russian)

It is shown that a separation of nitrogen isotopes can be achieved by the reduction of nitric acid by metallic mercury according to the following reaction: $(Hg + 8HNO_3 = 3Hg_2(NO_3)_2 + 2NO\uparrow + 4H_2O$. In addition to the separation of isotopes by broken chemical bonds, a separation by isotopic exchange takes place following the reaction: $N^{15}O(gas) + HN^{14}O_3$ (liquid) $\rightleftharpoons N^{14}O$ (gas) $+ HN^{15}O_3$ (liquid). Both reactions enhance heavy nitrogen isotope accumula-

tion in nitric acid. Further the sodium nitrate is reduced to ammonia and the equilibrium is shifted towards $N^{14}H_3$. Multiple repetitions of the process in the solution increase the concentration of the heavy nitrogen isotope in the nitric acid salts. When all the mercury nitrate is used up in the ammonium absorption reaction, the ammonia is taken up in 1 N hydrochloric acid solution and converted into pure nitrogen by sodium hypobromite. (R.V.J.)

16404 ELECTROLYTICAL Fe^{55} SOURCE PRODUCTION. H. Schaefer and G. Vormum (Institut für Angewandte Isotopenforschung der Institute für Medizin und Biologie der Deutschen Akademie der Wissenschaften, Berlin). Kernenergie, 7: 111-13(Feb. 1964). (In German)

A method by which thin ^{55}Fe layers are obtained from $^{55}FeSO_4-(NH_4)_2SO_4$ solutions through electrolysis is described. The pH value of these solutions is maintained within narrow limits by the addition of acetate buffer solutions. A bath with 14 and 30 ma cathode current density yielded a stable deposit, which corroded at a very slow rate. This deposit accumulated until the entire electrolyte was used up. (OTS)

16405 PROCESS FOR OBTAINING DEUTERIUM-ENRICHED HYDROGEN COMPOUNDS. Klaus Wetzel (to VEB Vakutonik). British Patent 950,627. Feb. 26, 1964. Filed Mar. 14, 1960.

A process is described for obtaining deuterium-enriched hydrogen compounds in which an azeotropic mixture of nitric acid and water is distilled under reflux to set-up counter-current liquid-vapor extraction conditions between the ascending vapor phase and the descending liquid phase. The deuterium-enriched concentrate is removed in the overhead product, and the nitric acid in the deuterium depleted acid residue is recovered and recycled as an azeotropic mixture. (R.E.U.)

16406 IMPROVEMENTS IN OR RELATING TO A PROCESS FOR THE ENRICHMENT OF AMMONIA IN DEUTERIUM. (to Commissariat a l'Energie Atomique and Houilleres du Bassin du Nord et du Pas-De-Calais). British Patent 951,791. Mar. 11, 1964. Priority date Aug. 28, 1959, France.

A process and apparatus are described for the enrichment of NH_3 in D_2 by isotopic exchange between liquid NH_3 and gaseous H_2, using a cold and hot tower system. In this process, the gaseous phase is saturated with the vapor of the liquid phase containing a nonvolatile alkali metal amide catalyst, and liquid NH_3 containing the catalyst is circulated in a closed circuit to make up the NH_3 removed in the saturated gaseous phase. In order to avoid an accumulation of catalyst, a makeup quantity of liquid NH_3 containing catalyst is introduced into the circuit, the makeup quantity being sufficient to allow saturation of the gaseous phase and withdrawal of the liquid having the most catalyst. (D.L.C.)

16407 SEPARATING ISOTOPES OF HYDROGEN. Peter C. Vander Arend (to Air Products and Chemicals Inc.). U. S. Patent 3,126,267. Mar. 24, 1964. Filed July 24, 1959.

A method and an apparatus are described for the separation of deuterium from hydrogen by low-temperature liquefaction and fractionation. The method comprises feeding hydrogen into a fractionation zone at condensation temperature to produce overhead and a pool of liquid, withdrawing overhead, compressing the overhead, introducing the compressed overhead into heat exchange with the pool to liquefy the overhead, and returning the liquefied overhead to the fractionation zone above the feed. The apparatus has three fractionating columns for carrying out the method in cycle. (D.L.C.)

MATHEMATICS AND COMPUTERS

16408 (CERN-64-13(Vol.I)(p.1-86)) NOTIONS DE STATISTIQUE ET APPLICATIONS. (Notions on Statistics and Applications). L. Jauneau and D. Morellet (Paris. École Polytechnique). (In French)

The main statistical concepts and methods commonly used in high-energy physics are reviewed and demonstrated. Laws of probability, statistical tests, and estimation methods are covered. (D.C.W.)

16409 (CERN-64-13(Vol.I)(p.147-67)) NOTES ON THE MONTE CARLO METHOD. A. Werbrouck (Italy. Istituto Nazionale di Fisica Nucleare, Turin).

The Monte Carlo method, particularly the choice of variables, is discussed. Three types of probability distribution are considered. The nuclear cascade problem as solved by Monte Carlo techniques is outlined, and a skeletal FORTRAN program illustrating the solution is given. (D.C.W.)

16410 (CERN-64-13(Vol.I)(p.169-72)) THE BASIC EQUATIONS FOR THE MONTE CARLO METHOD. D. Hudson (European Organization for Nuclear Research, Geneva).

The basic equations for the Monte Carlo method are proved. (D.C.W.)

16411 (CERN-64-13(Vol.I)(p.173-6)) GENERATING RANDOM NUMBERS ON A COMPUTER. D. Hudson (European Organization for Nuclear Research, Geneva).

A method for generating random numbers using sequences generated by congruences of whole numbers is outlined. The computer application of the technique is described using an example. (D.C.W.)

16412 (CNAEM-14) ON THE ALGEBRAIC STRUCTURE OF THE CLUSTER EXPANSIONS IN STATISTICAL MECHANICS. Cahit Arf, Kaya Imre, and Ercuement Ozizmir (Turkey. Atomic Energy Commission. Çekmece Nuclear Research Center, Istanbul). Feb. 1964. 32p.

The partitions of a finite set are regarded as operators which divide this set into parts, and the commutative algebra generated by these operators is developed and studied. Two different representation spaces (one of which is graded) of this algebra are constructed. As an application, some properties connected with the cluster expansion of the statistical mechanics are deduced within the context of the present formalism by establishing an operator isomorphy between the representation spaces constructed herein and certain vector spaces generated by the distribution functions. (auth)

16413 (TID-4005(Pts.3&4 Rev.2)) SUMMARIES OF PHYSICAL RESEARCH IN PHYSICS AND MATHEMATICS. (Division of Research, AEC). Mar. 1964. 278p.

The objectives and status of AEC-supported research projects in high-energy physics, nuclear structure, neutron physics, mathematics, stable and heavy nuclides, extra-nuclear properties of matter, and computers are summarized. The development of accelerators, data analysis systems, spectrometers, etc. is covered. (D.C.W.)

16414 (UCRL-7619) A PRECISION FLYING SPOT FILM DIGITIZER. Jerome A. G. Russell (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 13, 1963. Contract W-7405-eng-48. 11p.

A digitizer and data handling system that measures the locations of images on transparent film by automatically scanning an area with a mechanically generated flying spot of light is described. The location measurements are directly transmitted for processing to a digital computer, which also controls the digitizer operations. A 4 in. × 5 in. negative can be scanned by a roster with a pitch of 50 μ in about 3 min. (D.C.W.)

16415 ON DIRICHLET SERIES AND TOEPLITZ FORMS. Herbert S. Wilf (Univ. of Pennsylvania, Philadelphia). J. Math. Anal. and Appls., 8: 45-51(1964).

An operator, $Kf(x) = \int_1^\infty K(x,y)f(y)dy$, where $K(x,y)$ is symmetric, decreasing, and homogeneous of degree -1 (i.e., $K(x,y)\epsilon\mathfrak{IC}$), is defined. Similarity between the kernel $K(x,y)$ of $\mathfrak{IC}$ and the Toeplitz kernel is noted. L_2 spectral theory of Toeplitz kernels depends on the behavior of the Fourier transform of the kernel just as L_2 spectral theory of $K(x,y)$ depends on the behavior of the Mellin transform of $K(t,1)$. Two applications of this similarity are proved. Then it is shown how the spectral theory of the matrices $K(\mu,\nu)|_{\mu,\nu=1}^{n}$ where $K(x,y)\epsilon\mathfrak{IC}$ is related to Dirichlet series in the same way as the Toeplitz sections, $G(\mu-\nu)|_{\mu,\nu=0}^{n}$, are related to trigonometric polynomials. (M.J.T.)

16416 REPRESENTATIONS FOR THE NONRELATIVISTIC COULOMB GREEN'S FUNCTION. Koichi Mano (Wentworth Inst., Boston). J. Math. Phys. (N. Y.), 5: 505-8(Apr. 1964).

Derivation of the representations for the nonrelativistic Coulomb Green's function is discussed. It is shown that the recently published representations, both in integral and closed forms, can be obtained from an expression for the difference of the diverging and converging wave solutions of the Green's function which is given in terms of the wave-functions summed by Gordon. (auth)

16417 EXACT CONDITIONS FOR THE PRESERVATION OF A CANONICAL DISTRIBUTION IN MARKOVIAN RELAXATION PROCESSES. H. C. Andersen (Massachusetts Inst. of Tech., Cambridge), I. Oppenheim, Kurt E. Shuler, and George H. Weiss. J. Math. Phys. (N. Y.), 5: 522-36(Apr. 1964).

Necessary and sufficient conditions were determined for the exact preservation of a canonical distribution characterized by a time-dependent temperature (canonical invariance) in Markovian relaxation processes governed by a master equation. These conditions, while physically realizable, are quite restrictive so that canonical invariance is the exception rather than the rule. For processes with a continuous energy variable, canonical invariance requires that the integral master equation is exactly equivalent to a Fokker-Planck equation with linear transition moments of a special form. For processes with a discrete energy variable, canonical invariance requires, in addition to a special form of the level degeneracy, equal spacing of the energy levels and transitions between nearest-neighbor levels only. Physically, these conditions imply that canonical invariance is maintained only for weak interactions of a special type between the relaxing subsystem and the reservoir. It is also shown that canonical invariance is a sufficient condition for the exponential relaxation of the mean energy. A number of systems (hard-sphere Rayleigh gas, Brownian motion, harmonic oscillators, nuclear spins)

are discussed in the framework of the above theory. Conditions for approximate canonical invariance valid up to a certain order in the energy are also developed and then applied to nuclear spins in a magnetic field. (auth)

16418 SOME INFINITE SUMS INVOLVING ZEROS OF $J_0(X)$. Leo F. Epstein (General Electric Co., Pleasanton, Calif.). J. Res. Natl. Bur. Std., 68B: 17-26(Jan.-Mar. 1964).

The limiting form for small ϕ values of the sums $F_r(\phi) \equiv \sum_{n=1}^{\infty} (1/\beta_n)^{2r} \exp(-\beta_n^2\phi)$, $G_r(\phi) \equiv \sum_{n=1}^{\infty} [(\exp(-\beta_n^2\phi))/(\beta_n^{2r-1}J_1(\beta_n))]$, $M_r(\phi) \equiv \sum_{n=1}^{\infty} (1/\beta_n)^{2r-1} \operatorname{erfc}(\beta_n\sqrt{\phi})$, and $N_r(\phi) \equiv \sum_{n=1}^{\infty} [(\operatorname{erfc}(\beta_n\sqrt{\phi}))/(\beta_n^{2r}J_1(\beta_n))]$, where r is an integer and β_n is the nth zero of the Bessel function $J_0(x)$, have been obtained. Related functions which arise in these problems are also considered. (auth)

16419 NOTE ON THE INVERSION OF THE BOLTZMANN EQUATION. Nicholas Rott (Univ. of California, Los Angeles). Phys. Fluids, 7: 559-61(Apr. 1964).

A short derivation of Wild's inversion of the Boltzmann equation is given. It is shown that if Wild's formula is to be used for an iterative solution, the Bhatnagar–Gross–Krook equation is recovered as the first step in a particular case, in which the "initial guess" is supported by classical mean-free-path concepts. Use of different initial guesses is considered, particularly those based on the Mott-Smith model. Connections between the iterative method and the classical expansion procedures are indicated. (auth)

16420 COMPACTIFICATIONS OF HOMOGENEOUS SPACES AND CONTRACTIONS OF LIE GROUPS. Robert Hermann (Northwestern Univ., Evanston, Ill.). Proc. Natl. Acad. Sci. U. S., 51: 456-61(Apr. 1964).

A method (imbedding G/H in a Grassman manifold) of compactification of homogeneous spaces is described for which H is a closed subgroup of a connected Lie group G and G/H is a noncompact irreducible Riemannian symmetric space. (R.E.U.)

16421 ON THE DIRECT CALCULATIONS OF THE REPRESENTATIONS OF THE THREE-DIMENSIONAL PURE ROTATION GROUP. Yehiel Lehrer-Ilamed (Israel Atomic Energy Commission, Rehovoth). Proc. Cambridge Phil. Soc., 60: 61-6(Jan. 1964).

Explicit formulas are given for calculating the matrix elements of the irreducible representations of the three-dimensional pure rotation group by the direct method. In addition explicit formulas are derived to calculate the representations of the finite elements of any group when the eigenvalues of the matrix representing the corresponding infinitesimal elements are given. (auth)

METALS, CERAMICS, AND OTHER MATERIALS

General

16422 (CEND-204) THE DEVELOPMENT AND TESTING OF UO_2 FUEL SYSTEMS FOR WATER REACTOR APPLICATIONS. Progress Report [for] Period Ending December 31, 1963. W. P. Chernock, C. E. Burdg, E. I. Veil, and G. Zuromsky (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Jan. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2863. 32p. (EURAEC-984)

Previously reported difficulties with the thermal conductance test apparatus were overcome. Tests were performed with centerline temperatures as high as 2600°C using direct water cooling of the clad and a W–25% Re alloy heater. When tests are performed with only gas and radiation cooling of the clad, centerline temperatures of about 1800°C with corresponding clad temperature of about 1150°C represent the maximum obtainable with the present geometry before electrical shorting through the UO_2 becomes significant. Thermal conductivity and thermal effective conductance values were obtained from these tests. Results of tests aimed at defining the length-to-diameter ratios representative of an infinite tube under collapse pressures indicated values of 8 to 9 for 1.9 cm dia. tubes with wall thicknesses of 0.05 to 0.124 cm. These data were used as the basis for sizing the vessel which has been ordered for collapse testing. Further analyses of spacer wire-to-tube weld failures obtained after 2000 temperature reversals (at least seven times greater than that anticipated in one power reactor lifetime) at a tube-to-tube temperature difference of 23°C (a factor of 2.5 times that anticipated in a typical water reactor cluster) indicated embrittled spacer wires at the weld joint. This embrittlement may result from the weld wire compositions. Parallel welding efforts are being initiated using nominal 347 composition wire and 347 weld wire, respectively. The program is being extended to Zircaloy clusters. (auth)

16423 (GEMP-197) RESEARCH ON CHROMIUM-BASE ALLOYS EXHIBITING HIGH-TEMPERATURE STRENGTH, LOW-TEMPERATURE DUCTILITY AND OXIDATION RESISTANCE. Progress Report for the Period Ending March 15, 1963. Carl S. Wukusick (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Contract AF33 (657)-8471. 23p.

The status of an experimental program to develop improved Cr-base alloys is discussed. A number of alloys were swaged and rolled to provide material for testing. Oxidation studies were performed on most of the experimental alloys. (auth)

16424 (GEMP-270A) HIGH-TEMPERATURE MATERIALS AND REACTOR COMPONENT DEVELOPMENT PROGRAMS. VOLUME I. MATERIALS. Third Annual Report. (General Electric Co. Advanced Technology Services, Cincinnati). Feb. 28, 1964. Contract AT(40-1)-2847. 159p.

Materials development programs are described on materials for use as fueled and nonfueled, high-temperature (1000 to 3000°C) reactor components; radiation effects on the time-, temperature-, and stress-dependent properties of selected high-temperature alloys and refractory metals; radiation effects in BeO as a function of composition, grain size, density, porosity, and irradiation temperature and dosage; the diffusion of fission gases (Kr, Xe, and I atoms) in ceramic oxides subsequent to their injection via ion bombardment; the fission product transport processes in refractory-metal fuel systems at temperatures exceeding 1700°C; and the chemistry involved in the use of a fertile material (thoria) in stabilized-fuel–BeO systems, and the development of such systems as internal conversion fuel elements. Creep-rupture tests were performed on some of the refractory metals and alloys to 2800°C in H_2 and Ar atmospheres for 1 to 1000 hours. It was found that arc-cast materials have more consistent and reproducible stress-rupture strengths and linear creep rates (second stage) for different sources of various materials than the same materials fabricated by the powder metallurgy processes, however powder metallurgy materials, have greater stress-rupture and creep strengths than do the arc-cast material. It was also found that the grain size of arc-cast materials heated above 2000°C is large (500 to 900 microns) whereas the grain size of powder metallurgy materials is usually relatively fine, although a duplex structure may be present. An improved processing and fabrication procedure for W–25Re sheet was developed which results in a homogeneous, sigma-free structure. In comparison with the commercial sheet, material produced by this technique exhibits superior stress-rupture and ductility characteristics at 2600°C in H_2. At reactor ambient temperature, irradiation of recrystallized W to a fast neutron dose of 2.5 to 3.2×10^{19} nvt reduced the creep rate by a factor of 2 and increased the stress-rupture life at 1100°C by a factor of 2.6. The elongation and the reduction in area were not affected by irradiation. Cold-worked W was less affected by irradiation; the creep rate was reduced by a factor of 1.6, while the rupture life was increased by the same factor. A 1900°C-anneal of an irradiated cold-worked specimen in a H_2 atmosphere did not completely remove the irradiation-induced hardening when compared with a similarly annealed control specimen. Annealing the recrystallized W at 1400°C for 1 hour prior to testing did not affect second-stage creep, but did eliminate the anomalous creep behavior in the primary stage of creep. Creep-rupture properties of Mo and W–25Re sheet specimens (fast neutron dosage of 7 to 8×10^{18} nvt) tested at 980 and 1100°C, respectively, were not significantly affected, although there was a slight, consistent reduction of creep rate. The rupture life of A-286 specimens, containing about 0.010% B and irradiated to a fast neutron dose of 5×10^{19} nvt, was within 25% of the control data. Specimens having only 0.0008% B concentration, however, was reduced 500%, apparently due to increasing, stress-enhanced grain growth with decreasing B content. Expansion was found to be the principal effect of irradiation in BeO. In low-temperature irradiations, the expansion is made up of expansion components from the lattice and from cracks which form at grain boundaries as a result of the greater expansion of the crystallographic c-axis than the a-axis. Both the lattice expansion and expansion resulting from grain boundary cracking increase with increasing dosage; the expansion from grain boundary cracking being 2 to 3 times larger than the lattice expansion at dosages of approximately 4 to 10×10^{20} nvt. Grain size influences the expansion by its effect on the dosage at which grain-boundary cracks occur. In elevated-temperature irradiadiations, the expansion is smaller the higher the temperature. For dosages up to 1.5 to 10^{21} nvt, it can be approxi-

mated by the relationship: $\{(\Delta V/V) \cong (K/A)[1 - \exp(-At)]\}$ where $\Delta V/V$ is the percentage increase in volume exclusive of grain-boundary separation, K is the defect production rate, A is the annealing rate, and t is the time of irradiation. Strength, elastic constants, and the thermal expansion of BeO are essentially unchanged if grain-boundary cracks are avoided. Once cracks have formed, the strength changes are slightly less severe in specimens of small grain size. (auth)

16425 (NP-13741) EFFECT OF LOW DENSITY INERT GAS FLUSH ON OXYGEN–COLUMBIUM REACTION AT 1500°F TO 2000°F. Quarterly Report. (Aero Vac Corp., Troy, N. Y.). [nd]. Contract NASw-722. 18p.

The study of the effect of a low density gas flush shows promise of reducing the cost of metallurgical furnaces as well as raising the attainable purity in the work zone. The particular situation investigated was the ability of argon to remove and keep out contaminant gases from the test area. A gas flow rate of 2 atm. cc/sec resulted in an impurity gas pressure of less than 10^{-6} torr in the test area while the contaminant gas pressure immediately adjacent was 1 torr. (auth)

16426 (UNC-5068) CARBIDE FUEL DEVELOPMENT. Progress Report, April 1, 1963 to June 30, 1963. A. Strasser, D. Stahl (United Nuclear Corp. Development Div., White Plains, N. Y.); K. Taylor, and J. Anderson (Carborundum Co, Niagara Falls, N. Y.). Sept. 30, 1963. Contract AT(30-1)-2899. 22p.

Experiments were performed to synthesize carbon stabilized (UPu)O. The products were mixtures of dioxide- and monoxide-type phases, and contained about 1 wt % carbon. Measurements of lattice parameters vs time indicated a change with $(U_{0.8}Pu_{0.2})C_{0.95}$ which was not evident with $(U_{0.95}Pu_{0.05})C_{0.98}$. Microprobe analyses of $(U_{0.8}Pu_{0.2})C_{0.95}$ + 0.1% Ni concluded that the second-phase sesquicarbide had a higher Pu/U ratio than the monocarbide matrix. Compatibility tests between $(U_{0.95}Pu_{0.05})C_{0.98}$ and type 316 stainless steel, niobium, and niobium–1% zirconium alloy for 1000 hr at 816°C showed no reaction. Zircaloy-2 is believed to have reacted with the fuel at a temperature as low as 593°C, after 1000 hr. Examination of coefficient of expansion specimens after testing showed no change in chemical analysis or microstructure. All $(U_{0.8}Pu_{0.2})C_{0.95}$ specimens operated in-pile, close to design conditions. Four specimens reached their target burnups of 4.9×10^{20} fissions/cm^3, and were removed from the reactor for post-irradiation examination. (auth)

16427 (WAPD-244) FABRICATION DEVELOPMENT OF BORON CARBIDE AND BORON CARBIDE + SILICON CARBIDE MIXTURES FOR POSSIBLE APPLICATION AS LUMPED BURNABLE POISONS IN PWR-2. S. F. Kaufman (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Jan. 1964. Contract AT(11-1)-Gen-14. 46p.

Wafers having densities greater than 99% theoretical were produced from B_4C and SiC powder mixtures ranging from 0 to 80 vol % SiC. The effects of starting powder purity and size, blending and hot pressing variables, volume fraction of SiC upon density, and microstructure are presented. The effect of density, B_4C particle size, and B_4C volume fraction upon the corrosion behavior in 680°F water is given. Factors affecting the preparation of hot-pressed B_4C containing boron-enriched or depleted in the isotope B^{10} are also discussed. The fabrication of these wafers into Zircaloy-clad elements by eutectic diffusion bonding and gas-pressure bonding, as well as the characteristics of these plate-type elements are described. (auth)

16428 (AEC-tr-6366) OBSERVATIONS ON THE EFFECT OF AN ELECTRICAL CURRENT ON SEGREGATION. Rémi Tougas and André Hone. Translated for Ames Lab., Ames, Iowa, from Can. Met. Quart., 2: 281-9(July-Sept. 1963). 9p.

The efficiency of processes of metal purification by solidification can be increased by the passage of an electric current through the solid-liquid interface during progressive solidification. In the case of the tin-lead system, for instance, for a given degree of purification, the rate of solidification can be increased by a factor of approximately five by the use of direct current instead of HF induction heating. (auth)

16429 CARBONS AND GRAPHITES—THEIR PRODUCTION AND USE. M. Clifford Brockway. Battelle Tech. Rev., 13: 3-8(Mar. 1964).

New types of carbons and graphites, with improved properties, and the processes for producing them are discussed. Very high temperature hot working is one of the new processes discussed, along with the development of methods for making pyrolytic graphite in massive shapes. Other developments include the commercial manufacture of carbon and graphite in textile form, and the production of highly impermeable cellulose carbon and vitreous carbon. (P.C.H.)

16430 INVESTIGATION OF THE PROCESS OF REDUCTION OF LANTHANUM AND CERIUM OXIDES BY ALUMINUM IN A VACUUM. G. V. Samsonov and V. A. Podyorgin (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. RSR, No. 12, 1609-12(1963). (In Ukrainian)

The results of an investigation of the aluminothermal reduction of lanthanum oxide (La_2O_3) and cerium dioxide (CeO_2) in a vacuum are presented. The reduction reaction occurs with formation of aluminum suboxide AlO and intermediate reaction products in the form of aluminates and lower oxides of rare earth metals. (auth)

16431 ELECTRODEPOSITION IN FUSED SALT BATHS OF POWDER ALLOYS OF ZIRCONIUM–NIOBIUM. C. Decroly and R. Winand (Université Libre, Brussels). J. Less-Common Metals, 6: 132-51(Feb. 1964). (In French)

Experiments were carried out to study the possibility of producing alloys of zirconium and niobium by fused salt electrolysis. Powders of these alloys were obtained by electrolysis of melts containing sodium chloride, zirconium tetrafluoride, and potassium fluoniobate at 900°C. On the basis of measured cathodic polarization curves, it was possible to choose the bath composition to obtain a given alloy. Changes with time in the composition of the alloys and in current efficiency were also studied. (auth)

16432 VOPROSY FIZIKI METALLOV I METALLOVEDENIYA. (Problems in Metal Physics and Metallography). Sb. Nauchn. Tr., Inst. Metallofiz., Akad. Nauk Ukr. SSR, No. 17, 1-212(1963).

The structures of various metals and alloys are discussed. The theory of ordering in ferromagnetic materials, x-ray scattering by crystals with dislocations, mechanisms of plastic deformation, annihilation of electrons and positrons in metals, impurity effects, phase transformations, self-diffusion, neutron irradiation effects on thermoelectric properties, crystal structure, and diffusion and oxidation processes are considered. (C.E.S.)

16433 CRYSTALLOGRAPHY AND CRYSTAL PERFECTION. PROCEEDINGS OF A SYMPOSIUM HELD IN MADRAS 14-18 JANUARY 1963 AND ORGANIZED BY THE

UNIVERSITY OF MADRAS. G. N. Ramachandran, ed. London, Academic Press, 1963. 381p. 75s; $12.00.

Various aspects of crystallographic techniques are discussed including methods of crystal structure analysis. Particular emphasis is placed on the phase problem and anomalous dispersion, crystal perfection and disorder electron and neutron diffraction, and instrumentation. Separate abstracts were prepared for 3 papers. (L.B.S.)

For abstracts of individual papers see: 16055, 16352, and 16434.

16434 ON THE EFFECT OF THE IMPURITIES ON NEUTRON SCATTERING BY CRYSTALS. Ivar Waller (Uppsala Univ.). p.189-95 of "Crystallography and Crystal Perfection." London, Academic Press, 1963.

It is shown how, by using Green's function, the effect of isolated impurities can be calculated for harmonic lattice vibrations. Explicit formulae are given for the one-phonon scattering by local vibrations. (auth)

16435 METHOD FOR PRODUCING HIGH PURITY MONOCRYSTALLINE BERYLLIA FIBERS AND PLATELETS. Eugene I. Ryshkewitch and Allen R. Sheets (to National Beryllia Corp.). U. S. Patent 3,125,416. Mar. 17, 1964. Filed Mar. 7, 1962.

A process is given for rapidly obtaining single crystal fibers and platelets of BeO. The process is based on the fact that BeO reacts with water vapor above 1200°C to form $Be(OH)_2$ vapor, which then deposits as BeO when cooled. The process comprises heating BeO to from 1200 to 2000°C in a confined space in the presence of a carrier gas containing 35 to 100% water vapor to form $Be(OH)_2$ vapors, and passing the resulting vapors over a surface of seed BeO crystals at a lower temperature. An induction furnace apparatus for carrying out the process is described. (D.L.C.)

16436 RADIOACTIVE DIAMOND COMPOSITION. Robert H. Wentorf, Jr. (to General Electric Co.). U. S. Patent 3,125,418. Mar. 17, 1964. Filed Mar. 20, 1961.

A method is given for synthesizing diamond with a radioactive surface coating, in order to provide a diamond material which does not develop or retain a charge of static electricity for any substantial period of time. The method comprises subjecting non-diamond carbon to a high pressure, preferably about 65,000 atm, at 1,200 to 2,200°C in the presence of a radioactive metal and a metal selected from the class of group VIII metals, Cr, Ta, Mn, and compounds of these metals which decompose to the metallic state under the reaction conditions. The resulting radioactive surface coating is 0.5 to 5 μ thick. (D.L.C.)

16437 CERIUM MONOSULFIDE ARTICLES. Donald H. Hollingsworth, Jr., Adger S. Johnson, Lawrence M. Litz, and Rudolph W. Oliver (to Union Carbide Corp.). U. S. Patent 3,125,421. Mar. 17, 1964. Filed June 1, 1960.

Cerium monosulfide articles, which are used as fugitive cores for hollow foundry castings, can be rendered resistant to oxidation and hydrolysis at high temperatures by being coated with a thin (0.0015 to 0.004 inch thick) coating of a refractory metal such as Ni, Cr, Zr, etc. The coating also enhances the strength characteristics of the articles. The coating metal should be the same as the metal to be cast, or at least compatible with this metal. Several ways of coating the articles are described briefly. (D.L.C.)

Corrosion

16438 (ANL-6785) CORROSION EXPERIENCE WITH ALUMINUM POWDER PRODUCTS. J. E. Draley, W. E. Ruther, and S. Greenberg (Argonne National Lab., Ill.). Nov. 1963. Contract W-31-109-eng-38. 28p.

Extrusions of aluminum alloy powder products were obtained from several sources and evaluated for corrosion resistance to high-temperature (260–350°C) water. Several types of tubing impact-extruded by ALCOA were tested. The stronger tubing (M655) failed very rapidly. The weaker tubing suffered extensive localized surface attack and penetration of the corrosion attack along the extrusion direction after prolonged (~3 months) exposure to 290°C water. A precorrosion heat treatment was effective in reducing both types of attack on the weaker tubing. Armour Research Foundation supplied several types of tubing extruded through a bridge die. All tubes failed on prolonged (~8 months) corrosion in 290°C water at the longitudinal bond lines. These lines were formed by the rejoining of the metal streams passing over the mandrel supports in the die during extrusion. Directly extruded tubing supplied by the Torrance Brass Company also failed on extended exposure to 290°C water. Many experimental rod extrusions (from Armour Research Foundation and Trefimetaux) exhibited corrosion resistance to static 290°C water equivalent to that of wrought alloys. The Trefimetaux specimens were also tested in rapidly flowing water at 315°C. Under these conditions a corrosion rate significantly faster than for the wrought alloy was measured. (auth)

16439 (CEA-2393) RECHERCHE D'ALLIAGES DE ZIRCONIUM COMPATIBLES AVEC LE GAZ CARBONIQUE SOUS PRESSION JUSQU'A 500 OU 600°C. (Research into Zirconium Alloys Resistant to Carbon Dioxide under Pressure at Temperatures of up to 600°C). P. Baque, R. Dominget, and J. Bossard (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1963. 78p.

Zirconium is a metal having a relatively low neutron capture cross section and a high melting point; it is thus possible to consider its use in particular as a canning material for fuel elements in CO_2-cooled nuclear reactors. A preliminary study of several types of zirconium showed that the metal is already strongly oxidised in this gas at 500°C. The "breakaway" phenomenon is generalised; the oxidation rate is then linear and depends on the carbon dioxide pressure. An attempt was therefore made to find binary and tertiary alloys in order to improve the metal behavior. Several interesting compositions were found: 1, 1.6, and 2.5 per cent of copper, 2 per cent of vanadium, and 0.05 and 0.5 per cent of calcium. Tertiary copper–molybdenum and copper–phosphorus alloys are also less liable to oxidation and in particular do not exhibit the "breakaway" phenomenon even after a prolonged treatment at 600°C. (auth)

16440 (WAPD-283) EFFECTS OF SILICON, NITROGEN, AND OXYGEN ON THE CORROSION AND HYDROGEN ABSORPTION PERFORMANCE OF ZIRCALOY-2. S. Kass, J. D. Grozier, and F. L. Shubert (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Nov. 1963. Contract AT(11-1)-Gen-14. 44p.

The corrosion properties of Zircaloy-2 are shown to be altered by the presence of small quantities of silicon or nitrogen. Increasing nitrogen contents of the alloys are noted to produce increased total corrosion and decreased time for transition in the weight gain-time kinetics. Silicon additions tend to produce higher weight gain values but, at the same time, render the alloy less susceptible to hydrogen absorption during aqueous corrosion exposure. The silicon additions, furthermore, minimize the very deleterious effects

upon corrosion resistance that occur due to slowly cooling the alloy through or hot working in the alpha plus beta region. A marked dependence of the hydrogen absorption by Zircaloy-2 upon prior thermal treatment was also observed. (auth)

16441 (WCAP-2056(Pt.I)) HIGH-TEMPERATURE SUPERCRITICAL-PRESSURE WATER LOOP. PART I. DESIGN AND DESCRIPTION. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Feb. 1964. Contract AT(30-1)-2948. 129p.

Includes Appendices A through H.

A loop developed to obtain basic heat transfer and corrosion information at subcritical and supercritical pressures is described. Loop system pressure is 2400 to 4000 psig. System flow is 2200 lb/hr at the maximum test section heat input of 600 kw, corresponding to a test section outlet temperature and pressure of 1100°F and 4000 psig, respectively. Loop functional requirements, instrumentation and control, test section design and instrumentation, and operational mode are covered. (auth)

16442 (EURAEC-960) STUDIES OF STEEL CORROSION IN HIGH-TEMPERATURE WATER AND STEAM. Quarterly Report No. 6, October 1–December 31, 1963. (Brussels. Societe d'Etudes, de Recherches et d'Applications pour l'Industrie). Jan. 31, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 089-62-7 RDB. 70p. (A translation)

Corrosion tests were made on stainless steel AISI 304 in steam and water at 300°C. It was established that the physical state of the oxidizing medium has no influence and that it is the temperature which determines the corrosion behavior observed. A test in steam at 500°C–100 kg/cm^2 showed that the classification of the surface states remains the same as that obtained in steam at 400°C–200 kg/cm^2. The difference between the surface states was, however, much more pronounced at 500°C than at 400°C, the electrolytically polished state being 10 times more corroded than the mechanically treated states. Initial passivation treatment has no influence on surface states. The respective influences of surface work-hardening and roughness cannot, at this state in the tests, be separated with certainty. Work-hardening does not modify the corrosion behavior for a given surface state. The possibilities offered by the hydrogen diffusion method were used for examining the influence of 300–20°C thermal cycles on the corrosion rate. It appears that such cycling does not modify the corrosion kinetics at 300°C at all. The loop for dynamic corrosion tests in high temperature water was the subject of several tests. Certain modifications were made concerning fine adjustment of the test parameters. (auth)

16443 (ORNL-tr-32) INHIBITING PROPERTIES OF THE PERTECHNETATE ION. V. I. Spitsyn, I. L. Rozenfel'd, V. P. Persiantseva, N. N. Zamoshnikova, and A. F. Kuzina. Translated from p.129-40 of "Korroziya Metallov i Splavov: Sbornik" (a publication of Gosudarstvennoe, Moscow, 1963). 20p. (Includes original, 7p.).

The passivating properties of $KTcO_4$ in neutral electrolytes were studied. It was found that the $KTcO_4$ ion is a very effective inhibitor, surpassing chromates, bichromates, and nitrites. Electrochemical studies showed that the pertechnetate ions have the capacity to sharply retard the anodic ionization of the metal. It was shown that under complete protection conditions the number of adsorbed pertechnetate ions is 38-116.10^{12} ion/cm^2- considerably less than that of the monomolecular layer. It can be concluded from adsorption and electrochemical measurements that the retarding mechanism of TcO_4^- is an adsorption one. Retardation of corrosion is associated with the adsorption of the inhibitor by the metal and by a decrease, induced by it, of the anodic ionization rate of the metal. (auth)

16444 THE CORROSION OF BERYLLIUM, BERYLLIUM OXIDE AND SEVERAL STEELS IN CARBON DIOXIDE. A. Draycott. Dechema Monograph., 45: 87-103 (1962). (In German)

Measurement was made of the corrosion rate of structural materials for nuclear reactors such as Be, BeO, and several steels containing 0 to 18% Cr, 0 to 18% Ni, and 0 to 1% Mo in CO_2 with various amounts of H_2O and oxygen at 450 to 825°C. Corrosion rate as affected by temperature, pressure, gas flow rate, and specimen surface structure was investigated. (Rev. Metal Lit., 21: No. 3, March 1964)

16445 THE BATTLE AGAINST CORROSION. Philippe Berge. Euratom Bull., No. 1, 19-26(Mar. 1964).

Corrosion problems in nuclear reactors are discussed, with special attention to water-cooled reactors. Corrosion research programs covered jointly by Euratom and the U. S. are briefly reviewed. Steels and zirconium alloys are considered in water-cooled reactors. (P.C.H.)

16446 KORROZIYA METALLOV I SPLAVOV. (Corrosion of Metals and Alloys). Moscow, Metallurgizdat, 1963. 384p.

The corrosion and passivity of stainless steel, titanium, and titanium alloys are discussed. Anodizing of aluminum and titanium alloys, the corrosion of metals under the effects of an alternating current, the effects of ionizing radiation on corrosion processes, the atmospheric corrosion of metals, and the corrosion and protection of various metals are also considered. (C.E.S.)

16447 THE ROLE OF OXYGEN ON ATTACK OF REFRACTORY METALS BY ALKALI METALS. Willis T. Chandler and Nathan J. Hoffman (Atomics International, Canoga Park, Calif.). 13p. (CONF-373-5)

From Technical Conference on Applied Aspects of Refractory Metals, Los Angeles, Dec. 1963.

Several roles for oxygen in promoting attack of refractory metals by alkali metals are postulated. Most of the roles are variations of oxidation/reduction reactions and polyoxide formation. The refractory metals discussed are pure Mo and Nb, and Nb plus 1% Zr alloy. Tests at 1600, 1800, and 2500°F were also run on W and Ta, and at 1600°F for Hf, Zr, Inconel X, and 310 stainless steel. The alkali metal discussed is cesium. (P.C.H.)

16448 BERYLLIUM ALLOYS. Thomas Raine and James Alan Robinson (to Associated Electrical Industries Ltd.). British Patent 952,488. Mar. 18, 1964. Filed Mar. 8, 1961.

Alloys of beryllium containing from 0.05 to 3.0 wt % titanium or zirconium were prepared to provide a beryllium-base material that has good corrosion resistance to moist, hot carbon dioxide without substantially sacrificing the neutron transparency of the material. The alloys also possessed greater ductility than pure beryllium. These alloys were prepared by consumable-electrode arc melting followed by direct fabrication. (M.C.G.)

16449 NUCLEAR REACTOR FUEL MEMBERS. Robert D. Leggett, Robert K. McGeary, and Eber K. Halte-

man (to Westinghouse Electric Corp.). U. S. Patent 3,126,323. Mar. 24, 1964. Filed Apr. 19, 1956.

The corrosion resistance of gamma-phase U base alloys containing Mo and/or Nb to water and steam may be increased by adding small amounts of Pt. Preferred compositions are (Mo + Nb) 5 to 12%, Pt 0.5 to 2%, and balance U. The fabrication of such alloys for use in reactor fuel elements include hot working, a homogenizing anneal at ~900°C, and a further anneal for >7 days at 350 to 525°C. The effects of 0.3, 0.6, and 1.2% Pt additions to U–9% Mo alloys on their corrosion rate in hot water at 650°F are shown graphically. Zr alloy claddings suitable for fuel elements utilizing the U base alloys are considered. (D.L.C.)

Fabrication

16450 (AD-431672) WELDING OF REFRACTORY METALS. Interim Report No. 5, October 1, 1963–December 31, 1963. D. J. Seman and F. D. Seaman (Universal-Cyclops Steel Corp., Bridgeville, Penna.). Feb. 1964. Contract NOw-63-0043-c. 26p.

Investigations were made on the effect of InFab atmosphere on bend transition temperature and weld chemistry of TZM, B-66, 90 Ta–10W, and W. Data are given, along with parameters for the multipass welding schedules. (P.C.H.)

16451 (AD-432273) DEVELOPMENT OF VERY HIGH STRENGTH BERYLLIUM WIRE. Bimonthly Report No. 1, December 6, 1963 to February 6, 1964. E. A. Murphy and R. G. O'Rourke (Brush Beryllium Co., Cleveland). Feb. 6, 1964. Contract NOw-64-0162-c. 19p.

A process is being developed to produce high-strength beryllium fine wire. Material selection and known chemistry is listed along with the extrusion data of the selected alloys. The beryllium–iron alloys with 1.2 to 0.8% Fe were found not adaptable for the fabrication technique described and will be replaced with an alloy having 0.4% Fe. (auth)

16452 (HW-79290) SPECIFICATIONS FOR SWAGE-COMPACTED, MIXED OXIDE (UO_2–PuO_2) FUEL ELEMENTS FOR THE PRTR(MARK I-M). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 1, 1963. Contract AT(45-1)-1350. 42p.

Plutonium-containing, 19-rod cluster fuel elements have been fabricated for the Plutonium Recycle Test Reactor (PRTR) by swage compacting loose, mixed oxide powders in Zircaloy cladding. Some elements contain physical mixtures of UO_2 and PuO_2 while others contain high energy rate, pneumatic-mechanical impaction densified fuel particles (Nupac), in which PuO_2 is dispersed throughout UO_2. The swage compacted fuel rods feature swageable end caps which minimize the possibility of contamination spread during processing. Specifications governing the fabrication of these fuel elements were developed in detail during development of the fabrication process. (auth)

16453 (HW-79291) SPECIFICATIONS FOR VIBRATIONALLY COMPACTED, MIXED OXIDE (UO_2–PuO_2), FUEL ELEMENTS FOR THE PRTR (MARK I-L). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 1, 1963. Contract AT(45-1)-1350. 41p.

Plutonium-containing, mixed oxide, 19-rod cluster fuel elements have been fabricated for the Plutonium Recycle Test Reactor. The particulate, oxide fuel was densified in Zircaloy cladding tubes by vibrational compaction. Some elements contain physical mixtures of UO_2 and PuO_2 while others contain high density impacted particles ("Nupac" process) in which the PuO_2 is dispersed throughout the UO_2. Detailed specifications governing the fabrication of such elements were developed during development of the fabrication process. (auth)

16454 (NMI-7019) FINE-GRAINED URANIUM BY THE ADDITION OF SHOT DURING CASTING. W. J. Richmond (Nuclear Metals, Inc., West Concord, Mass.). May 31, 1963. Contract [AT(30-1)-1565]. 11p.

The addition of uranium shot to a stream of molten uranium before solidification was investigated as a means of refining the grains of a uranium casting. Even with the most effective means developed for adding the shot, grain refinement was not achieved with –48, +80 shot equivalent to 7% of the uranium poured. (auth)

16455 (ORNL-3539) THORIUM–URANIUM-233 OXIDE (KILOROD) FACILITY—ROD FABRICATION PROCESS AND EQUIPMENT. J. D. Sease, A. L. Lotts, and F. C. Davis (Oak Ridge National Lab., Tenn.). Apr. 1964. Contract W-7405-eng-26. 102p.

A fabrication facility with related process equipment has been constructed to fabricate fuel rods containing ^{233}U and thorium oxide by the bulk oxide-vibratory compaction route and is now in operation at the Oak Ridge National Laboratory. While the initial motivation for the facility was to fabricate ^{233}U-bearing ½-in.-dia × 46-in.-long Zircaloy-2 clad fuel rods for criticality experiments at the Brookhaven National Laboratory, sufficient flexibility has been incorporated into the facility to accommodate a variety of development work on a pilot-plant scale. The facility consists of a number of permanent alpha-tight cubicles which are shielded with 4¼-in. steel. The fabrication process is carried out remotely in these cubicles with the exception of several gloved-hand operations which occur where the dexterity required for manipulation exceeds that of the remote castle-type tongs. The fabrication equipment that has been installed in the facility performs the operations associated with oxide powder comminution and classification, vibratory compaction of oxide in fuel tubes, tube closure, fuel rod decontamination, and fuel rod inspection. Both the facility and the process equipment are described in detail, and detailed assembly drawings of the process equipment are included. (auth)

16456 (TID-7689(p.119-25)) A STUDY OF THE SOURCES OF CERAMIC INCLUSIONS IN CAST GAS TURBINE COMPONENTS BY RADIOTRACER ANALYSIS. L. L. Packer (United Aircraft Corp., East Hartford, Conn.); C. M. Phipps (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.); and J. N. Williams (United Aircraft Corp., East Hartford, Conn.).

A study was made to determine if the crucible used in casting gas turbine blades and vanes was a source of ceramic inclusions in the blade and vane structures. A crucible was labeled with a radioisotope by neutron activation. Results gave positive proof of the pick up of crucible material by the molten metal. The included ceramic was carried into the mold cavity and became a part of the cast assembly. (M.C.G.)

16457 (AI-Trans-41) THE DEPENDENCE OF SHEET METAL SURFACE ROUGHNESS ON PRETREATMENT AND ITS BEARING ON THE ADHERENCE OF GROUND-COAT PORCELAIN ENAMEL. A. Petzold and M. Kruger. Translated by Anthony Cornell (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.), from Mitt. Ver. Deut. Emailfachleute, 8: No. 1, 1-10(1960). 22p.

Investigations regarding the effect of different pretreat-

ment methods on the surface roughness of sheet metals were carried out. The samples were degreased, bright-annealed, pickled with HCl or H_2SO_4, repickled with HNO_3, or pickled altogether in HNO_3, as well as blasted with corundum, or round or edge steel pellets. The result was an increase in the depth of surface depression somewhat in the order of the pretreatments; however, the first four methods mentioned were found to be close together in their effectiveness. The pretreated samples were each porcelain-enameled with a cobalt and a nickel base: their strength was determined by means of impact and torsion testing, as well as with the MPI adherence test. It was found that the resistance of the enamel increased by leaps and bounds upon transition to sheet metals pickled with HCl and H_2SO_4, although the depth of surface depression had hardly increased. On sheet metals treated with HNO_3 the degree of adherence only improved insignificantly over sheet metals pretreated with nitric acid. Notwithstanding the great roughness of sandblasted sheet metals, the resistance of the enamel was poorer than that on pickled sheet metals. (P.C.H.)

16458 (EURAEC-811) WELDING OF VERY THICK STEELS. Quarterly Report No. 8, July 1–September 1963. (Ghent. Rijksuniversiteit and Soudometal, S. A., Brussels). Work Performed under United States–Euratom Joint Research and Development Program. 183p. Contract 042-61-9RDB. (A translation)

Topics covered on the welding of very thick steels include: statistical analysis of the Charpy V impact strength tests of 100-mm thick joints, automatically welded under submerged flux; final perfecting of the tandem welding parameters; analytical study of the tensothermal embrittlement and the restoration of basic steel and filler metals; study of local mechanical properties of prenotched joints; determination of the semi-global mechanical properties of the filler metals in automatic welding using global bend tests; determination of the Robertson arrest temperatures of filler metals in manual and automatic welding using 30-mm thick welded joints; creation of artificial flaws (cracks and lack of fusion) in automatic welding; and determination of the tensile properties at low temperatures for the basic steel and filler metals with a view to interpreting the results of semi-global and global tensile tests. (N.W.R.)

16459 (EURAEC-962) METHODS USED FOR MAKING PRESSURE CONTAINERS. Quarterly Report No. 8, October 1–December 31, 1963. (Neratoom, N. V., The Hague). Jan. 27, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 069-61-12 RDN. 64p. (A translation)

The fourth seam according to the submerged-arc welding method with single welding head was welded with the SAF UM 40-D wire in the same conditions as the first three welded seams. The seam was ultrasonic tested. The results of these tests are summarized together with a summary of the preparation, welding, and nondestructive and destructive examinations of the first weld. In connection with the submerged-arc welding with double welding head, a fourth and a fifth seam were welded and evaluated. The third weld was mechanical tested and evaluated. The fourth seam was made by coffered welding under CO_2. No difficulties were encountered; it took 67 min for welding the 143 cm long seam. (N.W.R.)

16460 ELECTRODEPOSITION OF THORIUM OXIDE ON ALUMINIUM. H. R. von Gunten and W. Scherle (Federal Inst. for Reactor Research, Wurenlingen, Switzerland). Intern. J. Appl. Radiation Isotopes, 15: 167-8(Mar. 1964).

Thorium dioxide was deposited on aluminum plates by electrolyzing thorium from a solution of ethanol (8–10 mg Th/100 ml C_2H_5OH) at a current of about 3mA/cm^2. Very uniform and adherent coatings were obtained even in tubes with diameters of only 5 mm. Addition of a few drops of an ethanol-ammonia mixture to the electrolyte solution increased the homogeneity and the adherence of the coatings considerably. Heating the Al tubes to 500–550°C for an hour transformed the deposits into white ThO_2. A procedure for the electrodeposition of Th in Al tubes of 15 mm diameter is also given. (P.C.H.)

16461 PRODUCTION OF THIN TITANIUM–DEUTERIUM AND TITANIUM–TRITIUM TARGETS. A. M. Morozov and A. I. Shalnikov. Pribory i Tekhn. Eksperim., No. 6, 169-70(Nov.-Dec. 1963). (In Russian)

Equipment for producing thin (0.01–0.1 μ) titanium–deuterium and titanium–tritium targets in which all successive operations are conducted without intermediate contact with the atmosphere is described. (tr-auth)

16462 PROCESS FOR THE MANUFACTURE OF TUBULAR BODIES WITH FINS. Ennemond Maillet (to Commissariat a l'Energie Atomique). British Patent 952,304. Mar. 11, 1964. Priority date Jan. 26, 1962, France.

A process is described for manufacturing tubular bodies with flat fins arranged in a herringbone pattern. The process comprises the successive stages of construction of a blank forming an external envelope surface of the fins, movement of a rotary tool into a position with the axis of rotation at an oblique angle to the axis of the body, and translational motion of the tool at right angles to its axis of rotation along a predetermined path. Various forms of the process are described. (D.L.C.)

16463 PRODUCTION (OF BLOCKS) OF SINTERED URANIUM OXIDE FOR NUCLEAR REACTORS. Horst Scheibe. German Patent 22,462. Dec. 27, 1961.

The sintering capacity of blocks of U oxides to UO_2 starting powder of stoichiometric composition or to weakly oxidized powder was raised by adding sufficient amorphous UO_3 powder in a ball mill before pressing to give a final mixture of the ratio $O_2 : U = 2.18$. A 1% polystyrene benzene solution was added as binder. The mass was compressed under a pressure of 1500 kg/cm^2 and sintered at 1000°C in an H_2 atmosphere or in another protective medium. (Referativnyy Zhurnal, Khimiya, No. 22, 1962)

16464 PRODUCTION OF CARBON MASSES. Michael Stuart Thomas Price (to United Kingdom Atomic Energy Authority). U. S. Patent 3,126,430. Mar. 24, 1964. Priority date Sept. 24, 1957, Great Britain.

A method is given for producing baked carbon masses of high density (≥1.69 g/cc) which can be graphitized to form articles of density ≥1.75 g/cc. The method comprises forming a shaped plastic mass of powdered carbon and a binder, supporting the mass within a container by packing tightly carbon grist around it, and baking the mass in a nonoxidizing atmosphere at 800°C and 180 psig. (D.L.C.)

Properties and Structure

16465 (AERE-R-3943) SOME STUDIES IN THE DEVELOPMENT OF FINE-GRAINED GRAPHITES FOR NUCLEAR APPLICATIONS. F. Roberts, B. Longstaff, and T. R. Jenkins (United Kingdom Atomic Energy Authority.

Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Aug. 1963. 36p.

A study of the factors influencing the distribution of pore sizes in fine-grained graphite was carried out. This led to the formulation of a grist mixture for a graphite, HX20, with pore characteristics suitable for impregnation by the furfuryl alcohol process. The latter process was developed for the production of low permeability graphite fuel tubes and boxes required for making DRAGON-type HTR reactor fuel elements. Since there is scope for the investigation of alternative raw materials for the manufacture of fine-grained graphites for advanced gas cooled reactors, in order to reduce costs and to develop products that might be expected to have increased resistance to dimensional changes and to oxidation under irradiation in pile, more recent work has concentrated on the use of coke as filler rather than graphite dust and carbon black. (P.C.H.)

16466 (BMI-1664) A STUDY OF THE TENSILE FRACTURE AND MICROSTRUCTURE OF URANIUM. Ellis L. Foster, Jr., ed. (Battelle Memorial Inst., Columbus, Ohio).

Tensile tests and exhaustive metallographic examinations were conducted in an effort to relate the mechanical properties, the chemical compositions, and the structures of five grades of Savannah River Laboratory uranium to their irradiation stability. Subsequent tensile tests were conducted on seven types of National Lead (Ohio) uranium containing various levels of iron, aluminum, and silicon. Special attention was devoted to the mode of fracture exhibited by the various materials and to the existence of grain-boundary phases and intergranular fracture. No evidence was noted of grain-boundary failure at temperatures up to 450°C. Most or all failures were precipitated by secondary phases not associated with the grain boundaries. No definite connection was noted between the chemical composition and the tensile properties of the materials that could be related to their irradiation stability. A supplementary study concerned with the substructure and fine-particle distribution in cast uranium was also undertaken. The major accomplishment of this study was the development of metallographic techniques. Particularly interesting were the microstructures revealed by vacuum-cathodic etching. (auth)

16467 (BMI-X-277) PROGRESS ON USAEC/AECL COOPERATIVE PROGRAM. Quarterly Report for Period, December 1963–February 1964. Stanley W. Porembka (Battelle Memorial Inst., Columbus, Ohio). Mar. 9, 1964. Contract W-7405-eng-92. 16p.

The long term creep-rupture properties of sintered aluminum powder alloys (M-257, M-583, SAP-895, and SAP-915) are determined at 700, 800, and 900°F. The creep-rupture properties of annealed and 15% cold-worked Zircaloy-2 are determined at 550, 650, and 750°F. (N.W.R.)

16468 (CEND-203) BURNABLE POISON ADDITIONS TO UO_2. Progress Report, Period Ending December 31, 1963. R. C. Brayer and W. P. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Jan. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3107. 25p. (EURAEC-985)

Gross differences in the potential for formation of volatile boron were calculated for flowing argon and conditions encountered during thermal gradient testing versus those in an operating fuel element. The reaction, $UO_{2(s)} + B_4C_{(s)} \rightarrow UB_{4(s)} + CO_{2(g)}$, with subsequent dissociation of UB_4 is believed to be responsible for volatile boron species. Dissociation of B_4C was also considered and was dismissed from further consideration as a factor in an operating fuel element as a result of the low equilibrium dissociation pressure of 10^{-6} atmospheres at 2400°K. Results of the potential for the occurrence of the above reaction in various systems were in fair agreement with experimental data obtained during thermal gradient tests and suggest a plausible explanation for variations observed. The evaluation also indicated that the potential for the above reaction in an operating fuel element was negligible, indicating that boron migration should not be a problem. (auth)

16469 (EURAEC-821) MECHANISMS OF DIFFUSION AND PRECIPITATION OF HYDROGEN IN ZIRCONIUM. Quarterly Report No. 3, June 1–September 30, 1963. (Bologna. Universita. Istituto di Fisica "A. Righi"). Work Performed under United States–Euratom Joint Research and Development Program. Contract 051-62-11-RDI. 58p.

The hydrogenation of zirconium is studied by electron microscopy, x-ray and resistivity measurements, optical metallography, mechanical tests, hydrogen absorption through oxide films, quenching-deformation techniques, and diffusion and precipitation mechanisms. The results of these studies are discussed along with testing equipment developed for testing purposes. (N.W.R.)

16470 (EURAEC-913) THE DEVELOPMENT OF A NEW DETERMINATION OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE. Quarterly Report [No. 9, October–December 1963]. H. C. van Elst (Netherlands. Nijverheidsorganisatie, TNO. The Hague). Jan. 31, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 068-61-11-RDN. 40p.

Determination of Propagation Velocity and Emitted Stress Waves of Running Brittle Fracture in Steel at the Robertson Test. The framing camera recordings of the propagation of a running brittle fracture in four reactor vessel steels in the brittle-ductile transition region were continued. The fracture velocity was found to be lower in high-quality steels than in low carbon construction (Thomas) steel, and the fracture propagation was stepwise, with the length of the steps increasing with temperature. The arrest temperatures in isothermal Robertson tests showed large discrepancies with these in the thermal gradient Robertson tests. Charpy-V and tensile tests were performed. Isoclinics of the stress waves were recorded using the framing camera, a photostress layer, and polarized light on the low carbon construction (Thomas) steel. The Generation of Stress Waves with Explosive and Electrical Means. Progress is reported for the stress wave generation by magnetic interaction of discharge currents and by the exploding wire technique. The Development of A Test Method to Determine the Ductile-Brittle Transition Temperature in Steel on Small Specimens. Shock-wave damping measurements on steel specimens were continued, and transition curves were traced for four reactor vessel steels. These transition curves gave transition temperatures which were in reasonable agreement with the arrest temperatures in the Robertson test. (D.L.C.)

16471 (EURAEC-978) THE EFFECT OF RADIATION ON THE DUCTILE-BRITTLE TRANSITION IN PRESSURE VESSEL STEELS. Special Report No. 3. ETCH-PIT OBSERVATIONS CONCERNING TWINS IN IRON AND IRON ALLOYS. J. Spreadborough, D. Langheinrich, and E. Anderson (Battelle Memorial Inst. International Div., Geneva). Jan. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 095-62-12-RDS. 13p.

Etch-pit procedures may be used to gain qualitative information about processes involving twins in samples de-

formed to strains of the order of 10%: a visual representation of the local strain fields may be obtained together with evidence which may be interpreted in favor of the emissary dislocation model for twin growth. The etch-pit procedure reveals about 10% of the dislocations throught to be present and indicates local stresses around twin/twin or twin/grain boundary intersections at least 20% higher than the overall stresses at distances of about ten microns or five times the width of the twins. (auth)

16472 (HR-64-253) THE MECHANICAL BEHAVIOR OF MAGNESIUM OXIDE AT HIGH TEMPERATURES. R. B. Day and R. J. Stokes (Honeywell Research Center, Hopkins, Minn.). Jan. 1964. Contract AF33(616)-7465. 47p. (AD-431615)

Magnesium oxide crystals show a wide variety of deformation and fracture modes under tension at high temperatures. These modes are determined by the number of slip systems operating concurrently in a given volume. (i) At low temperatures slip is confined to a single ⟨110⟩ {110} system and plasticity is limited by stress concentrations which develop where slip switches from one plane to another. (ii) At intermediate temperatures ⟨110⟩ {110} slip systems at 90° to each other can interpenetrate but those at 60° cannot. Mechanical properties then depend on initial slip distribution. When slip is confined to two 90° systems there is little work hardening before crystals neck down to a knife edge ductile fracture. When slip is confined to 60° systems crystals work harden and fracture by cleavage. (iii) At high temperatures dislocations can interpenetrate on all systems and polygonization can occur. After easy glide the crystals work harden and elongate over 100 percent before fracturing in a completely ductile manner. The transition from one mode to another depends on strain rate. The relative ability for 90° or 60° systems to intersect is discussed in terms of dislocation interactions. (auth)

16473 (HW-SA-3370) PuN AND THE REFRACTORY NITRIDES. D. F. Carroll (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 17, 1964. Contract AT(45-1)-1350. 10p.

The properties of PuN are compared with these of PuO_2, PuC, UO_2, UN, and UC. A study was made of the thermal stability of PuN, UN, ThN, TiN, ZrN, and PuN–50 mole % UN by heating for 4 hr at 1800°C in vacuum and various atmospheres. ThN, TiN, and ZrN are quite stable in vacuum, while 100% of PuN, 53% of PuN–UN, and 19% of UN are lost. The melting behavior of these nitrides was also studied. Solid solutions of PuN–UN were obtained over the whole composition range, and x-ray results are given. It is concluded that PuN looks attractive as a possible reactor fuel material but that its high decomposition pressure presents a serious problem. (D.L.C.)

16474 (NP-13738) DIFFUSION IN B.C.C. METALS. R. A. Wolfe and H. W. Paxton (Carnegie Inst. of Tech., Pittsburgh). Mar. 1, 1964. Contract Nonr-760(08). 27p.

In order to study the diffusion mechanism in bcc metals, diffusion coefficients of Cr^{51} and Fe^{55} were determined in Fe–12 wt % Cr alloy, Fe–17 wt % Cr alloy, Cr, and V. The diffusion coefficients D are plotted on a log D vs reciprocal temperature graph and compared with literature data. The results for Fe–Cr alloys show that the diffusion behavior is different at low and high temperatures and varies in a complex manner with composition. The diffusion behavior in anomalous bcc elements is discussed. (D.L.C.)

16475 (NP-13755) THE NOTCH IMPACT BEHAVIOR OF TUNGSTEN. Technical Report No. 22. R. J. Stokes and C. H. Li (Honeywell Research Center, Hopkins, Minn.). Dec. 1963. 33p.

A comparison is made of the fracture behavior of tungsten rods in three conditions, recrystallized, recovered, and wrought. Notched specimens subjected to a 50 in. lb impact load showed ductile brittle transitions at 700°C, 490°C, and 440°C respectively. The recrystallized material had an equiaxed grain structure and fractured by simple cleavage from a grain boundary source at all temperatures up to 700°C. The wrought and recovered material had an elongated fibrous structure and at low temperatures fractured by cleavage originating from the notch. As the transition temperatures were approached cleavage was preceded by more and more intergranular splitting which deflected the crack front into planes parallel to the tensile axis. The enhanced toughness of wrought and recovered tungsten was attributed both to its inability to initiate cleavage because no grain boundaries were suitably oriented perpendicular to the tensile stress and its inability to maintain cleavage because of intergranular splitting ahead of the crack. (auth)

16476 (NP-13759) MECHANICAL AND PHYSICAL PROPERTIES OF TZM MOLYBDENUM ALLOY SHEET AND OF TUNGSTEN SHEET. Third Quarterly Progress Report, May 1–July 31, 1963. (Southern Research Inst., Birmingham, Ala.). Aug. 15, 1963. Contract N600(19)-59530. 17p.

The mechanical and physical properties of TZM molybdenum alloy sheet and of tungsten sheet are investigated. Specimens for determination of the recrystallization temperature of the 0.100-in.-thick tungsten sheet have been heat treated. (auth)

16477 (ORNL-3588) MONOCLINIC-CUBIC TRANSFORMATION IN THORIUM DICARBIDE. N. A. Hill and O. B. Cavin (Oak Ridge National Lab., Tenn.). Apr. 1964. Contract W-7405-eng-26. 9p.

Thorium dicarbide was found to transform at 1415 ± 10°C from the low-temperature monoclinic structure to a face-centered cubic structure with $a_0 = 5.808 \pm 0.003$ Å at 1500°C. It was not possible to retain the high-temperature structure by quenching. (auth)

16478 (TID-7688(p.44-9)) TRITIUM DECORATION OF DEFECT STRUCTURES IN ALUMINUM. L. M. Foster (Aluminum Co. of America. Aluminum Research Labs., New Kensington, Penna.).

Studies were made of the distribution of hydrogen in aluminum by autoradiographic techniques, using tritium tracer. The results show that as little as 0.001 ppm tritium was completely segregated in quenched specimens. The structures that are revealed by tritium decoration are discussed in terms of vacancies. (D.L.C.)

16479 (TID-7689(p.86-9)) SURFACE SELF-DIFFUSION OF ADSORBED ATOMS. H. J. Arnikar, E. A. Daniels, and O. P. Mehta (Poona. Univ.).

Previous studies of adsorption on glass and metallic surfaces of labeled ions at micro and tracer concentrations showed that surface migration of adsorbed atoms can occur in heated mono- or multilayers. A method for determining the corresponding self-diffusion coefficients is described. A radiotracer study was made of the rate of variation of the thickness of the adsorbed layers. Diffusion in these adsorbed films was studied using films in which one half of the area is radioactively labeled and the other half is unlabeled. Results showed two types of adsorption: one type that follows a first order rate law and in which saturation is reached at or below the monolayer of one

adsorbate ion per adsorbent atom of surface, and another type in which the activity-adsorption time curves consisted alternately of steady rises and plateaus and the ratio of adsorbed ions to adsorbent atom in the first plateau varied from 1.2 to 1.65. It was concluded from this data that it is possible to restrict adsorption to any desired thickness within certain limits. Diffusion rates in multilayers were found to be higher than in monolayers. (M.C.G.)

16480 (TID-20326) DIFFUSION PHENOMENA IN THE LIQUID CADMIUM-LEAD BINARY SYSTEM. Morteza Mirshamsi, Andrew Cosgarea, Jr., and William R. Upthegrove (Oklahoma. Univ., Norman. Research Inst.). 1963. Contract AT(40-1)-2409. 165p.

The capillary reservoir technique with radioactive lead-210 and cadmium-115m were used to determine the self-diffusion coefficients of both cadmium and lead and the chemical diffusion coefficients in the liquid binary cadmium–lead system. The self-diffusion coefficients of pure cadmium and pure lead were obtained and were compared with the theoretical predictions. Good to excellent agreement between the experimental and predicted values (Walls and Upthegrove) was obtained. The self-diffusion coefficients of cadmium were measured in alloys containing 2.5 to 97.00 weight percent cadmium by determining the amount of active cadmium which has diffused out of a small bore capillary into an infinite reservoir for a given time. The effect of temperature on the diffusivity was determined between 290 and 460°C. The activation energy Q, and frequency factor D_0, were obtained and the maximum variation of these quantities was also investigated. The self-diffusion coefficients of lead were measured in alloys containing 2.5 to 97.00 weight percent cadmium by the same technique that was used for the cadmium self-diffusion measurements. The effect of temperature on the diffusivity of lead was determined between 290 and 480°C. The values of Q and D_0 in the Arrhenius relation were also obtained for lead from self-diffusivity data. The chemical diffusion coefficients were measured in the cadmium–lead system. These measurements were made for 2.268 to 96.00 weight percent cadmium in the alloys. These data were obtained in the temperature interval from 355.0 to 485.0°C. The diffusivities were assumed to be constant in small concentration intervals, and a solution to Fick's second law for constant diffusivity was used. The self-diffusion coefficients obtained were used with Darken's equation to calculate chemical diffusion coefficients. The results were compared with experimentally determined values of the chemical diffusion coefficients and satisfactory agreement was not obtained. However, the similarity of the shape of these curves and the common minima support Darken's model. When the curve calculated from this model is compared to the values which would be predicted if no thermodynamic correction were included, it is seen that Darken's approach is a significant improvement over the uncorrected model for this system. (auth)

16481 (UCRL-7559) SOME KINETIC AND THERMODYNAMIC PROPERTIES OF THE REFRACTORY METAL BORIDES AND NITRIDES. An Annotated Bibliography. M. Temple Milliken and Jean E. Senkin, comps. (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 1963. Contract W-7405-eng-48. 345p.

Approximately 1240 references, most in abstracted form, are presented on the kinetic, mechanical, and thermodynamic properties of the borides and nitrides of Al, Si, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, and W. The references are arranged alphabetically by author. An index based on a coordinate outline is included. (D.L.C.)

16482 (UCRL-7651) X-RAY MICROGRAPHY OF ALPHA PLUTONIUM. E. M. Cramer (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 15, 1964. Contract W-7405-eng-48. 15p.

A simple Berg-Barrett x-ray camera was adapted to study grains in alpha plutonium. Grains that can be observed by optical means consist of numerous sub-grains generally less than 10μ in width that appear to be disoriented by angular differences of more than 1°. Limitations of the camera with regard to resolution and measurement of angles are presented. (auth)

16483 (AEC-tr-6374) CONCENTRATION REGION OF HOMOGENEITY OF CARBIDES OF TRANSITION METALS OF THE FOURTH AND FIFTH GROUPS WITH NaCl STRUCTURE. V. A. Tskhai and P. V. Gel'd. Translated by Helen J. Chick and N. H. Krikorian (Los Alamos Scientific Lab., N. Mex.), from Fiz. Metal. i Metalloved., 16: 495-6(1963). 5p.

The bonding in $Me^{IV}C_x$ ($TiC_{0.867}$ and $ZrC_{0.867}$) and $Me^{V}C_x$ ($VC_{0.65}$ and $NbC_{0.70}$) is discussed in relation to C vacancies. It is shown that the formation of the new phase Me^{V}_2C is connected with the appearance of adjacent vacancies, while in the case of $Me^{IV}C_x$, the presence of adjacent vacant positions does not lead to the formation of a new phase. (D.L.C.)

16484 (AI-Trans-34) RELAXATION PHENOMENA IN COLDWORKED COPPER CAUSED BY INTERSTITIAL ATOMS. Johann Voelki and Werner Schilling. Translated by Anthony Cornell (Atomics International, Div. of North American Aviation, Inc., Canoga Park), from Physik Kondendierten Materie, 1: 296-315(1963). 28p.

The internal friction of polycrystalline 99.999% pure copper wires coldworked at 23°K to 4% elongation was measured with an inverted torsion pendulum. Besides the wellknown maxima at 50°K (Bordoni maximum) and 165°K, a maximum at 250°K was found. From the study of the annealing behavior and structure of this maximum it was concluded that the reorientation of dumbbell interstitials in the stress field of the applied force is the process responsible for the friction maximum. (auth)

16485 (EURAEC-829) BASIC STUDY OF A FEW EMBRITTLEMENT FORMS AFFECTING JOINTS WELDED ON HIGH-RESISTANCE STEEL. Quarterly Report No. 7, July 1–September 30, 1963. (Société Anonyme des Forges et Ateliers du Creusot, Le Creusot, France). Work Performed under United States–Euratom Joint Research and Development Program. Contract 073-61-12-RDF. 12p. (A translation)

Progress is reported on studies concerned with the influence of gamma grain size on the impact strength of steel, the influence of work-hardening in the vicinity of $A_{C\,1}$ during welding cycles, the electronic computer analysis of the Ms point temperature measurements effected with a magnetothermodynamic apparatus, transformation anomalies detected with this apparatus, and the cracking sensitivity of the basic steel grade as estimated by CTS-type weldability tests. (N.W.R.)

16486 (EURAEC-969) RARE GAS DIFFUSION IN SOLIDS. Quarterly Report No. 14, October 1–December 31, 1963. (Hahn-Meitner-Institut für Kernforschung, Berlin). Jan. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 094-62-9-RDD. 4p. Translation of EU-B-28.

No marked difference was found in the Xe release from UO_2 single crystals either in vacuum or in an atmosphere

of 100 mm He. Several isothermal anneals at 1300°C with single crystal discs of UC showed release kinetics that could not be described by volume diffusion. The release reached a saturation value at F = 0.013. The sublimation kinetics of ThO_2 crystals was measured in the apparatus used for PAD-anneals between 1600 and 2200°C. For the model system CaF_2 the release of Ar in the region 700 to 1300°C with an activation energy of 67 kcal/mole was shown to be attributed to an interstitial mechanism. Below 700°C a different mechanism with an activation energy of about 10 kcal/mole predominated. (auth)

16487 (UCRL-Trans-1030(L)) AN ANALYTICAL METHOD IN STATISTICAL MECHANICS. Ryōgo Kubo. Translated by Y. Tagami (Univ. of California, Lawrence Radiation Lab., Livermore), from Busseiron Kenkyu, No. 1, 1-13(1943). 12p.

The Ising model of ferromagnetism or alloys is discussed using a matrix formulation. In the one-dimensional case the problem reduces to a linear difference equation, and the thermodynamic properties are obtained in terms of the largest eigenvalue of a matrix that contains the Boltzmann factors for the various interaction energies. It is shown that there is no phase transition in this case. In the two- or three-dimensional cases, non-linear partial difference equations may appear, and a phase transition seems to be possible. Such a transition would depend on the asymptotic behavior of a 2^n-dimensional matrix and would be associated with the degeneracy of the largest eigenvalue of this matrix. It is also shown that when the restriction to nearest-neighbor interactions is removed, there is still no phase transition in the one-dimensional system, except possibly in certain exceptional cases. (editor)

16488 MAGNETIC PROPERTIES OF URANIUM PHOSPHIDES. W. Trzebiatowski and R. Troć (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw and Technical Univ., Warsaw). Bull. Acad. Polon. Sci., Ser. Sci., Chim., 11: 661-4(1963).

Magnetic properties of uranium phosphides were measured by the Faraday method using a microbalance. A lack of ferromagnetic impurities was confirmed by the constancy of the susceptibility within the magnetic fields ranging from 9.7 to 15.6 koe. Data are tabulated. (P.C.H.)

16489 X-RAY ANALYSIS OF TECHNETIUM ALLOYS WITH RHODIUM, PALLADIUM AND PLATINUM. J. Niemiec (Technical Univ., Warsaw). Bull. Acad. Polon., Sci., Ser. Sci., Chim., 11: 665-9(1963).

The structure of technetium alloys with Rh, Pd, and Pt, based on x-ray examination, are presented. No intermetallic phases for the three alloys were found at the temperatures studied. However, the existence of a primary limiting solid solution of fcc structure and a final limiting solid solution of hcp structure was ascertained. The structural differences between Tc (hcp lattice) and Rh, Pd, and Pt (fcc lattice) exclude the possibility of formation of continuous solid solutions. Data on structural parameters are tabulated. (P.C.H.)

16490 ON THE CHARACTERISTICS OF THE SYSTEM $CaO-MgO-Al_2O_3-ZrO_2$. A. S. Berezhnoi and R. A. Kordyuk (Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr., RSR, No. 12, 1617-20(1963). (In Ukrainian)

Co-existent phases were determined; the system $CaO-MgO-Al_2O_3-ZrO_2$ was divided into elementary tetrahedrons and their relative volumes v_i were calculated. Quaternary compounds were not found in the system. In the pseudo-binary subsystem $CaZrO_3-MgAl_2O_4$ the eutectic melts at 1920°K with an $MgAl_2O_4$ content about 40 pC by weight and in the subsystem $MgO-Ca_7Al_6ZrO_{18}$ at 1730°K with an MgO content about 15 pC by weight. The eutectic in system $ZrO_2-MgAl_2O_4$ melts at 2130°K. The lower melted quaternary eutectic melts approximately at 1600°K (determined by calculation) and is located near the ternary eutectic of the system $CaO-MgO-Al_2O_3$. Taking into consideration the decrease in the concentration area containing not more than 10 pC of the melt with the temperature, the investigated system has great advantages over the systems $CaO-MgO-Al_2O_3-SiO_2$ and $CaO-MgO-Al_2O_3-TiO_2$, but it also contains only 3 pC of this area at 2273°K, which makes the system $CaO-MgO-Al_2O_3-ZrO_2$ useful only for obtaining materials with a moderate temperature of usage. (auth)

16491 STRUCTURAL FEATURES OF CARBON AND GRAPHITE. E. A. Kellett and H. P. Rooksby (General Electric Co. Ltd., Wembley, Eng.). G.E.C. J. Sci. Tech., 31: No. 1, 28-36(1964).

Investigations on the relation between graphite and amorphous carbons, anisotropy of thermal expansion of graphite, and variation of thermal vibration of carbon atoms with temperature are discussed. It is noted that the thermal expansion of fabricated solid bodies of graphite, measured by the usual methods of dilatometry, is much lower than the volume expansion of the constituent crystals themselves. Measurements showed that the amplitude of vibration of carbon atoms normal to the layer planes increases with increase of temperature much faster than the interlayer spacing. In consequence movement and shear of the layer planes will become increasingly impeded as the temperature rises. (P.C.H.)

16492 INFLUENCE OF CYCLIC THERMAL LOADING OF STABILITY OF FORM, SIZE AND STRUCTURE OF METALS AND ALLOYS. A. S. Zaymovskii. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 7-16(1963). (In Russian)

Cyclical thermal loading of sheet specimens made of Al, Armco iron, Ni, silumin, stainless steel, brass, Albrass, and U in various temperature ranges was used to determine the influence of face centered cubic lattice and body centered cubic lattice and of the number of thermal cycles on changes in form (elongation, contraction and warping), in size, and in microstructure. The tendency of bcc metals to contract into sphere-like shape during cyclical thermal loading, and tendency of fcc metals to elongate or thin out is discussed. (Rev. Metal Lit., 21: No. 3; March 1964)

16493 PLUTONIUM ALLOYS. S. T. Konobeevskii and V. I. Kutaitsev. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 17-24(1963). (In Russian)

Thermal expansion, lattice structure and parameters, microhardness, electric resistance, magnetic susceptibility, and allotropic temperatures were determined for six (alpha, beta, gamma, sigma, eta, and epsilon) modifications of metallic Pu. Constitutional diagrams are given for Pu–Li, Pu–Be, Pu–Mo, Pu–Zr, Pu–U, Pu–Al, and Pu–Fe systems. (Rev. Metal Lit., 21: No. 3, March 1964)

16494 INVESTIGATION OF THE TERNARY SYSTEMS Cb–W–Zr AND Cb–Mo–Zr. E. M. Savitskii and A. M. Zakharov. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 108-16(1963). (In Russian)

Electric arc melting of Nb–W–Zr and Nb–Mo–Zr alloys with various constituent concentrations in a helium medium, annealing the ingots at 1900 to 1800°C, reduction 50% by forging, and water quenching at 1100 to 2100°C are described. Determinations were made of the phase composition, component solubility, melting points, microstruc-

ture, and microhardness as a function of chemical composition and melting temperature. Constitutional diagrams and lattice structure of the solid solutions are given. 18 references. (Rev. Metal Lit., 21: No. 3, March 1964)

16495 INFLUENCE OF PLASTIC DEFORMATION ON PROPERTIES AND STRUCTURE OF AGING MAGNESIUM ALLOYS THAT CONTAIN NEODYMIUM. M. E. Drits. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 157-70(1963). (In Russian)

Alloys Mg–Nd, Mg–Nd–Mn, and Mg–Nd–Mn–Ni containing from 0.16 to 7.5% Nd, were quenched at 530°C, cold forged with 5 to 18% reduction, aged at 200 to 300°C and tested at 20 to 300°C. Tensile strength, yield strength plasticity, and grain size were determined as affected by testing temperature, Nd concentration, and cold deformation degree. (Rev. Metal Lit., 21: No. 3, March 1964)

16496 RECRYSTALLIZATION AND SOFTENING OF MAGNESIUM ALLOYS. M. E. Drits and E. S. Kadaner. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 211-23(1963). (In Russian)

High purity Mg was alloyed by additions of up to 1 at. % of Mn, Al, Nd, Ca, Th, Ce, Zr, Ni and Ba. The alloys were cast, hot rolled, annealed at 50 to 450°C, and reduced 60% by cold rolling. A study was made of the effect of alloying agents and their concentration (from 0.1 to 1 at. %) on recrystallization temperature, recrystallization rate, heat resistance, creep, and hardness. Composition-recrystallization temperature diagrams are given. (Rev. Metal Lit., 21: No. 3, March 1964)

16497 INFLUENCE OF PLASTIC DEFORMATION AND HEAT TREATMENT ON ANISOTROPY OF STRENGTHENING AND WEAKENING OF BERYLLIUM BRONZE. B. I. Puchkov, A. G. Rahshtadt, I. L. Rogel'berg, and I. M. Sokolova. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 224-32(1963). (In Russian)

A study was made of the effect of alternating cold deformation and tempering on water-quenched beryllium bronze (2.56% Be; 0.3% Ni) and the anisotropy of hardness, electrical conductivity, and elasticity. (Rev. Metal Lit., 21: No. 3, March 1964)

16498 INTERACTION IN SYSTEMS REFRACTORY METAL–C–N. K. I. Portnoi and Yu. V. Levinskii. Issled. Splavov Tsvetn. Metal. Akad. Nauk SSSR, Inst. Met., No. 4, 279-85(1963). (In Russian)

Nitriding of TiC, ZrC, HfC, NbC, and TaC powders and carburization of TiN, ZrN, HfN, NbN, and TaN nitride powders at 1500 to 2500°C is described. X-ray and chemical analyses of the obtained solid solutions of refractory metal-carbonitride were made for equilibrium states, activation energies of carburization and nitriding, temperature dependence of lattice parameters, and thermal stability of their respective nitrides and carbides or mixed carbonitrides. (Rev. Metal Lit., 21: No. 3, March 1964)

16499 HIGH-TEMPERATURE BEHAVIOR OF $MoSi_2$ AND Mo_5Si_3. George B. Cherniack and A. Grant Elliot (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Am. Ceram. Soc., 47: 136-41(Mar. 21, 1964).

The high-temperature stability and behavior of $MoSi_2$ was studied by heating dense sintered specimens under a vacuum of 10^{-5} mm Hg in the temperature range 1700 to 2000°C. The resulting material was examined using physical measurements, x-ray analysis, and metallographic techniques. The decomposition of $MoSi_2$ into Mo_5Si_3 is described. The Mo_4Si_3-$MoSi_2$ eutectic temperature was determined as 1900°C, and the melting points of $MoSi_2$ and Mo_5Si_3 were determined as 1980 and 2085°C, respectively. (auth)

16500 THERMAL EXPANSION OF YTTRIA-STABILIZED ZIRCONIA. T. H. Nielsen and M. H. Leipold. J. Am. Ceram. Soc., 47: 155(Mar. 21, 1964).

The thermal expansion of yttria-stabilized zirconia was measured in air and in a high-oxygen atmosphere. Room temperature-to-1000°C expansion measurements were made in an automatic recording dilatometer. Measurements above 1000°C were made in an oxide induction furnace and the change in length of the specimen was measured with telemicroscopes. The mean coefficient of thermal expansion curves for ZrO_2 + 15 wt % Y_2O_3 are presented. There was no significant difference in the thermal expansion measured in the two atmospheres. (P.C.H.)

16501 ALLOYS OF THORIUM WITH CERTAIN TRANSITION METALS. III. THE SYSTEM THORIUM–PALLADIUM. J. R. Thomson (Imperial Coll. of Science and Tech., London). J. Less-Common Metals, 6: 94-9(Feb. 1964).

The thorium–palladium binary system was studied over the whole range of compositions in the temperature range 1000–1500°C mainly by metallographic and x-ray methods. At 1000°C the limit of solid solubility of thorium in palladium is between 15 and 17% and at this temperature seven intermetallic compounds are stable. Th_2Pd and ThPd crystallize directly from the melt at 1162 ± 12 and 1412 ± 12°C, respectively, while $ThPd_3$ melts above 1500°C; Th_3Pd_4 and Th_3Pd_5 are formed peritectically at 1325 ± 12 and 1387 ± 12°C, respectively. Phase relationships in alloys of 79–85% palladium were not established but two intermetallic compounds $ThPd_4$ and $ThPd_x$ occur in this composition range. There is a sharp minimum in the solidus and liquidus of the palladium solid solution at approximately 12% thorium and 1125 ± 12°C. (auth)

16502 HIGH TEMPERATURE MAGNETIC SUSCEPTIBILITY MEASUREMENTS ON THE TITANIUM–HYDROGEN AND NIOBIUM–HYDROGEN ALLOY SYSTEMS. D. W. Jones (Univ. of Birmingham, Eng.). J. Less-Common Metals, 6: 100-7(Feb. 1964).

The effect of hydrogen on the magnetic susceptibility of titanium and niobium was studied in the range of hydrogen pressures from 10 to 650 mm Hg, and in the temperature range 600 to 900°C. For both metals the effect is small, and at low hydrogen concentrations the change in susceptibility due to the dissolved hydrogen is comparable to the change in susceptibility of binary metal alloys over an equivalent range of electron atom/ratios. (auth)

16503 THE ZIRCONIUM–TUNGSTEN–TANTALUM SYSTEM. L. F. Pease and J. H. Brophy (Massachusetts Inst. of Tech., Cambridge). J. Less-Common Metals, 6: 118-31(Feb. 1964).

The ternary phase diagram for the zirconium–tungsten–tantalum system contains two planes of four-phase equilibrium and no ternary intermediate phases not in the component binary diagrams. One four-phase plane lies in the solidus surface at 1760°C and the other lies at 812°C corresponding to the alpha–beta zirconium ternary solid solution transformation. The W_2Zr compound extends into the system along a constant zirconium content line up to 12 at. % tantalum. Solid solution regions are of very limited extent. Experimental techniques employed included metallography, x-ray diffraction, incipient melting, electrical resistance measurements, electron microprobe analysis, and high-speed computer data reduction. (auth)

16504 TENSILE PROPERTIES OF PYROLYTIC TUNGSTEN FROM 1370 TO 2980°C IN VACUUM. J. L. Taylor and D. H. Boone (Jet Propulsion Lab., Pasadena, Calif.). J. Less-Common Metals, 6: 157-64(Feb. 1964).

The tensile properties of annealed pyrolytic tungsten were measured at a strain rate of 0.02/min from 1370 to 2980°C in vacuum. Data for powder metallurgy and plasma-flame single-crystal tungsten are shown for comparison. A few engineering stress–strain curves are given for pyrolytic and powder metallurgy tungsten. Although voids are present in the pyrolytic material after annealing, the voids that form and grow during testing have a more important detrimental effect on ductility. The as deposited anisotropy of the microstructure is maintained after recrystallization and enhances the tendency to void formation and growth. With the exception of one specimen that contained no voids, as the result of a lower annealing temperature, pyrolytic tungsten has a lower ultimate strength than powder metallurgy tungsten in the temperature range studied. (auth)

16505 TECHNETIUM COMPOUNDS WITH THE $MgZn_2$ STRUCTURE. J. B. Darby, Jr., L. J. Norton, and J. W. Downey (Argonne National Lab., Ill.). J. Less-Common Metals, 6: 165-7(Feb. 1964).

Studies were made on the occurrence of Laves phases upon alloying Tc with several lanthanide elements as well as Y. ATc_2 compounds were prepared by arc melting on a water-cooled copper hearth. Rare earth elements, whose purity was 99% or better, were Ce, Pr, Gd, Tb, Dy, Ho, Er, Tm, and Lu. The powder patterns of the compounds investigated were indexed as the $MgZn_2$-type structure and are tabulated. Powder patterns taken from alloys corresponding to $CeTc_2$ and $PrTc_2$ did not reveal the lines of a Laves-type phase. (P.C.H.)

16506 NEUTRON MAGNETIC SCATTERING FROM F.C.C. IRON ALLOYS. R. Nathans (Brookhaven National Lab., Upton, N. Y.) and S. J. Pickart. J. Phys. Chem. Solids, 25: 183-6(Feb. 1964).

Paramagnetic diffuse scattering of thermal neutrons by two γ phase iron alloys ($Fe_{0.88}Mn_{0.12}$ and $Fe_{0.71}Cr_{0.18}Ni_{0.11}$), measured at room and elevated temperatures, indicates that the iron carries a moment of approximately one-half Bohr magneton. Measurement of the coherent scattering at 4.2°K showed no evidence for antiferromagnetism in the stainless steel. (auth)

16507 STRUCTURE OF NIOBIUM CARBIDES. Nobuzo Terao (Union Carbide European Research Associates, Brussels). Japan J. Appl. Phys., 3: 104-11(Feb. 1964). (In French)

The preparation of thin films of two niobium carbides, NbC and Nb_2C, for electron diffraction studies was accomplished by heating in vacuo double evaporated films (carbon + Nb). NbC is formed by a carburization process in high vacuum, while thin films of Nb_2C are produced by decomposition of NbC in air at reduced pressure ($10^{-2} \sim 10^{-3}$ torr) by the reaction $2NbC + O_2 \rightarrow Nb_2C + CO_2$. The crystal structure of NbC is based on the f.c.c. lattice of Nb atoms and the carbon atoms occupy interstitial positions in a statistical manner. Nb_2C, however, shows a hexagonal superlattice structure of the same type as that of ϵ-phase of Fe_2N. (auth)

16508 THE TITANIUM–NIOBIUM SYSTEM. A. R. G. Brown, D. Clark, J. Eastabrook, and K. S. Jepson (Royal Aircraft Establishment, Farnborough, Hants, Eng.). Nature, 201: 914-15(Feb. 29, 1964).

An examination was made on the formation and aging characteristics of a martensitic α phase obtained in Nb–Ti alloys by quenching. The structure of the transformed alloys was determined by x-ray diffraction using water-quenched solid specimens, approximately 1 cm across. The structures of alloys containing more than 5 at. % Nb were anomalous. Many of the reflections from the α phase were split into two components the separation of which increased with increasing Nb content. The observed diffraction pattern is best interpreted in terms of a c-centered orthorhombic cell, which can be regarded as a simple distortion of the hexagonal cell of α-titanium. There was no evidence for segregation of Nb to special sites. Cell dimensions and diffraction data are tabulated. (P.C.H.)

16509 ANALYSIS OF EFFECTS OF DILUTE ALLOYING ADDITIONS ON THE GRAIN-SIZE OF URANIUM. J. H. Gittus (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.). Nature, 201: 916(Feb. 29, 1964).

An analysis was made of the extent to which the analogy that alloying elements retard and modify phase transformations in steel and uranium receives support from results in which Jominy end-quench data were produced for binary, ternary, and quaternary alloys of U with Mo, Cr, and Nb. (P.C.H.)

16510 NEUTRON DIFFRACTION OF IDEAL CRYSTALS USING A DOUBLE CRYSTAL SPECTROMETER. D. Sippel, K. Kleinstueck, and G. E. R. Schulze (Zentralinstitut für Kernphysik, Rossendorf, Ger. and Technische Universität, Dresden). Phys. Letters, 8: 241-2(Feb. 15, 1964).

Rocking curves in reflection and transmission of indium-antimony and germanium crystals, measured by using a double crystal spectrometer simultaneously with two BF_3 neutron detectors, are presented and discussed. Results of calculations are not given. (L.B.S.)

16511 A NEW TYPE OF LOW-TEMPERATURE RESISTANCE ANOMALY IN ALLOYS. B. R. Coles (Imperial Coll. of Science and Tech., London). Phys. Letters, 8: 243-6(Feb. 15, 1964).

The results of measuring the resistance of rhodium-iron alloys at low temperature and varying iron content showed that the increment in resistivity is a strong function of temperature, increasing by a factor of almost 3 between 1 and 50°K. Possible explanations for this anomaly are given. (L.B.S.)

16512 ON THE LOW TEMPERATURE THERMAL EXPANSION OF CERIUM. A. A. Gomes and A. M. De Graaf (Univ. of São Paulo, Brazil). Phys. Letters, 8: 246-7 (Feb. 15, 1964).

The anomalous behavior in the low temperature thermal expansion coefficient is discussed in terms of a semi-quantitative description of the thermal expansion coefficient of polycrystalline cerium as a function of temperature. This description also leads to an investigation of whether the f electrons occupy a bound state or a virtual state in the Friedel's sense. Satisfactory agreement was obtained between the equation for the thermal expansion coefficient and the experimental curve, confirming that f electrons occupy a virtual state. (L.B.S.)

16513 ON THE ELECTRICAL RESISTIVITY OF ALKALI VAPOURS AT HIGH DENSITIES. W. H. Young (Cornell Univ., Ithaca, N. Y.). Phys. Letters, 8: 253-5 (Feb. 15, 1964).

A scheme for calculating the electrical resistivity for a chosen element at a given density is presented, and

theoretical estimates of resistivity of alkali vapours at high densities and temperatures at a few thousand degrees are made. (L.B.S.)

16514 STUDY OF THE SHUBNIKOV-DE HAAS EFFECT. DETERMINATION OF THE FERMI SURFACES IN GRAPHITE. D. E. Soule, J. W. McClure, and L. B. Smith (Union Carbide Corp., Parma, Ohio). Phys. Rev., 134: A453-70(Apr. 20, 1964).

Measurements of the oscillatory magnetoresistance of a high-quality graphite single crystal were made for all angles θ between the magnetic field and the c axis, for magnetic fields up to 24 kG, and for temperatures from 1.22 to 4.22°K. The results were analyzed by a least-squares fitting to a generalized Landau formula. Oscillations due to electrons were observed for all orientations (including $H \perp c$, where the amplitude dropped by a factor 10^5), proving that the electron Fermi surfaces are closed. Although oscillations due to holes were not observed beyond $\theta \simeq 84°$, direct arguments show that the hole Fermi surfaces are also closed. Both electron and hole surfaces are elongated along the c axis and have anisotropy ratios of 12.1 ± 1.4 and about 17, respectively. The electron surface is approximately ellipsoidal, whereas the hole surface is similar except for extended ends giving it a diamond-like shape. The results are consistent with a moderate degree of trigonal asymmetry about the c axis. Comparison between the electron density found from the volume of the electron Fermi surfaces and that determined previously from the nonoscillatory galvanomagnetic data confirms the theoretical prediction that there are four electron Fermi surfaces in the Brillouin zone. More indirect arguments show that there are two hole surfaces. Consideration of the size and location of these surfaces along the six zone edges parallel to the c axis leads to a new determination of $\Delta \simeq -0.12$ ev for the band parameter which represents the difference of potential between the two types of atomic sites in the graphite lattice. Analysis of the temperature and magnetic field dependence of the oscillatory amplitude yields effective mass values in the basal plane of $(0.039 \pm 0.001)m_0$ for electrons and $(0.057 \pm 0.002)m_0$ for holes. These masses show an orientation dependence that is consistent with the derived Fermi surface anisotropies. The large amplitude and asymmetric shape of the oscillations in the magnetoconductivity, measured for $H \| c$ at 1.26 and 4.22°K, are accurately described by the theory of Adams and Holstein. However, there is an unexplained monotonic variation with magnetic field in the total magnetoconductivity. The effective change in temperature due to collision broadening ΔT is about 5 times greater than that estimated from the conductivity relaxation time. This discrepancy in ΔT is qualitatively explained and is related directly to the fact, established from the data of Berlincourt and Steele, that the ΔT found from magnetoresistance oscillations is greater than that found from susceptibility oscillations on the same sample. (auth)

16515 CALCULATION OF THE KNIGHT-SHIFT IN METALLIC BERYLLIUM WITH AN INTERMEDIATE OPW-TIGHT-BINDING METHOD. W. Schneider, L. Jansen, and L. Etienne-Amberg (Battelle Memorial Inst., Geneva). Physica, 30: 84-94(Jan. 1964).

Calculated values of the Knight-shift in metallic beryllium using the method of orthogonalized plane waves (OPW) are larger than the experimental upper limit by an order of magnitude. It is supposed that this discrepancy is due to the fact that the local character of the conduction electron wave functions near atomic nuclei in this metal is not accurately represented by the OPW-method. A modified variational calculation is proposed with a basis set consisting of orthogonalized plane waves plus tight-binding valence functions. A test calculation is carried out for the point Γ at the center of the upper surface of the second Brillouin zone, and the symmetry Γ_4^-. It is found that admixture of tight-binding 2s-functions results in a considerable decrease of the calculated Knight-shift; the corresponding energy level lies a little below that obtained on the basis of three symmetrized orthogonalized plane waves. A possible connection between these results and recent experimental observations on the Fermi-surface of beryllium is discussed. (auth)

16516 HEAT CAPACITIES OF THE METALS TERBIUM AND HOLMIUM BELOW 1°K. H. Van Kempen, A. R. Miedema, and W. J. Huiskamp [(Universiteit, Leiden)]. Physica, 30: 229-36(Jan. 1964).

The heat capacities of terbium and holmium metal were studied between 0.05 and 0.9°K. In this temperature region the main portion of the nuclear spin entropy is removed and quite accurate values for the parameters of the hfs interaction can be obtained from the experimental data. The results for the magnetic and the electric hfs parameters respectively are $a' = +0.320 \pm 0.005$°K, $P = +0.008 \pm 0.0015$°K for Ho, $a' = +0.152 \pm 0.002$°K, $P = +0.013 \pm 0.004$°K for Tb. (auth)

16517 HEAT OF SUBLIMATION AND VAPOUR PRESSURE OF STRONTIUM. A. J. Boerboom, H. W. Reyn, and J. Kistemaker (F.O.M.-Lanoratorium voor Massascheiding, Amsterdam). Physica, 30: 254-7(Jan. 1964).

By mass spectrometric analysis of the vapor effusing from a Knudsen cell of variable temperature the heat of sublimation of Sr was determined as 34.9 ± 0.15 kcal/gram atom between 500 and 650°C, corresponding with a value of 36.1 ± 0.15 kcal/gram atom at 298°K. The experimental value of the vapor pressure of Sr is given by $\log p_{(mm)} = -7{,}628/T + 7.498$ in the same temperature region. Only Sr atoms were found in the vapor, the concentrations of polyatomic species thus being lower than the detection limit of $1:10^6$. (auth)

16518 INVESTIGATION OF THE TEMPERATURE DEPENDENCE OF THE HARDNESS OF MOLYBDENUM IN THE RANGE OF 20-2500 C. V. A. Borisenko. Soviet Powder Met. Metal Ceram. (English Transl.), No. 3, 182-6 (May-June 1962).

Data were obtained on the temperature dependence of strain-hardened (cold-worked) and annealed molybdenum in the temperature range of 20 to 2500°C, with hardness being measured at temperatures above 1800°C. (Rev. Metal Lit., 21: No. 3, March 1964)

16519 DETERMINATION OF THE HARDNESS OF TUNGSTEN AT TEMPERATURES OF 2000-2700 C. V. A. Borisenko. Soviet Powder Met. Metal Ceram. (English Transl.), No. 3, 187(May-June 1962).

Hardness was measured by the one-sided flattening of conical specimens of tungsten in helium between the temperature range of 2000 to 2700°C. Hardness decreases as the temperature increases. (Rev. Metal Lit., 21: No. 3, March 1964)

16520 RESEARCH ON LOW DENSITY THERMAL INSULATION MATERIALS FOR USE ABOVE 3000°F. Karsten H. Styhr, Philip S. Hessinger, and Eugene Ryshkewitch (National Beryllia Corp., Haskell, N. J.). 27p. (CONF-50-20)

From American Ceramic Society 65th Annual Meeting, Pittsburgh, Apr.-May 1963.

The instigation of a research program on thermal conductivity of thermal insulation materials for use above 3000°F is discussed. The goal of the program is to find a means of retarding the photon contribution to the total or apparent thermal conductivity. The method employed is to introduce into each individual cell of a ceramic foam or cellular type of structure, a material that will disperse at high temperatures to form a radiation barrier and thus retard heat transfer. The evaluation of several ceramic materials is presented. (P.C.H.)

16521 THE ROLE OF FLAME-SPRAYED CERAMIC COATINGS AS MATERIALS FOR SPACE TECHNOLOGY AND THE SYSTEMS FOR APPLICATION. W. Maxwell Wheildon (Norton Co., Worcester, Mass.). 25p. (CONF-99-2)

From American Institute of Chemical Engineering, 49th National Meeting, New Orleans, Mar. 1963.

The basic concept of flame-spraying and methods of application are discussed. Some of the available coating materials and their functions for space technology applications are described; including 24 oxides, 12 carbides, and 8 borides. Physical, mechanical, electrical, thermal, and chemical properties of the ceramic materials are tabulated. (P.C.H.)

Radiation Effects

16522 (AD-429954) RADIATION-INDUCED CABLE CURRENTS. PART I. Dale R. Schallhorn, Edward E. Conrad, and Elmer I. Ellsworth (Harry Diamond Labs., Washington, D. C.). Dec. 30, 1963. 34p. (TR-1167)

RG-58/u, RG-59 B/u, and RG-62/u coaxial cables were exposed to pulsed radiation in the Diamond Ordnance Radiation Facility (DORF) reactor. Conductance and replacement currents were measured with two different cable configurations—one with the irradiated portion looped into a hairpin shape, the other with the irradiated end of the cable fastened to a terminal board and the entire assembly exposed to the radiation. Data were obtained as a function of distance from the radiation source in the reactor and in a neutron-free Co-60 gamma ray environment. The test results suggest that the polarity of the replacement current depends on the energy and type of incident radiation. It was determined that cables can be used to perform experiments in DORF without introducing more than 0.8 μa replacement current at the peak of the reactor pulse. (auth)

16523 (BM-RI-6391) EFFECT OF GAMMA RADIATION ON ANTHRACITE. Ralph Husack, G. A. Brady, and J. W. Eckerd (Bureau of Mines. Anthracite Research Center, Schuylkill Haven, Penna.). Apr. 1963. 31p.

The effect of gamma radiation on Pennsylvania anthracite and on reactions between anthracite and other materials was studied using a shielded, self-contained 23,000-curie cobalt 60 source. When anthracite was exposed to air at 65°C the reaction with oxygen was greater in the presence of radiation than in its absence. Although drop-shatter tests indicated that exposure to radiation decreased the resistance to breakage of anthracite, this evidence of structural weakening was not supported by the results of grindability or particle-size studies. Irradiation caused definite changes in the gases evolved from evacuated samples of anthracite; the percentages of hydrogen and carbon dioxide were increased, and the methane concentration remained unchanged. Carbon monoxide was evolved only from the unirradiated samples. Electron paramagnetic resonance (EPR) measurements indicated large differences between evacuated samples and those exposed to air. There was little or no difference between irradiated and unirradiated samples, except that the free-radical content of unirradiated samples of anthracite increased progressively with higher temperatures of evacuation, but in the case of irradiated samples, no such behavior was found. Attempts to produce carbon disulfide and calcium carbide by reacting anthracite with sulfur up to 120°C, and with calcium oxide up to 400°C, were unsuccessful. (auth)

16524 (EURAEC-979) FISSION GAS RELEASE FROM URANIUM DIOXIDE. Quarterly Progress Report No. 12, October–December 1963. (FIAT. Sezione Energia Nucleare, Turin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 021-60-9-RDI. 19p. (FN-E-40)

Ten experiments were conducted on nine Mallinckrodt and one CNEN pellets at burnups of 56 to 630 Mwd/t and test temperatures of 1330, 1400, and 1565°C. The xenon-133 release data show that the release rate parameter D′ decreases with irradiation, the amount of D′ decrease depends on the origin of the pellets, and a recovery of D′ decrease occurs for burnups higher than 100 to 200 Mwd/t. (D.L.C.)

16525 (NP-13657) NEKOTORYE ZAKONOMERNOSTI V IZMENENII OSNOVNYKH MEKHANICHESKIKH SVOISTV KONSTRUKTSIONNYKH MATERIALOV PRI NEITRONNOM OBLUCHENII. (Some Regularities in the Change of Fundamental Mechanical Properties of Constructive Materials Under Neutron Radiation). N. F. Pravdyuk and A. D. Amaeev (Akademiya Nauk S.S.S.R. Institut Atomnoi Energii). 1962. 38p.

Neutron radiation effects on the mechanical properties of low-carbon steel, lightly alloyed steel, austenitic steel, zirconium, and zirconium alloys were analyzed. The analysis indicated a pronounced dependence on irradiation time and temperature. (R.V.J.)

16526 (NP-13663) TEKHNIKA OBLUCHENIYA MATERIALOV V REAKTORE. (Techniques of Irradiating Materials in a Reactor). N. F. Pravdyuk, I. S. Panasyuk, V. I. Vikhrov, K. P. Dubrovin, A. N. Ivanov, V. I. Karpukhin, V. N. Kuznetsov, and V. A. Nikolaenko (Akademiya Nauk S.S.S.R. Institut Atomnoi Energii). 1962. 57p.

Techniques for irradiating construction and fissionable materials in a reactor, methods of isothermal irradiation, and various methods for determining neutron fluxes are considered. (tr-auth)

16527 (NRL-Memo-1393) IRRADIATION EFFECTS ON STRUCTURAL MATERIALS. Quarterly Progress Report, November 1, 1962–January 31, 1963. L. E. Steele, J. R. Hawthorne, and H. E. Watson (Naval Research Lab., Washington, D. C.). Feb. 15, 1963. 35p.

Progress in the study of the effects of neutron irradiation upon the properties of structural materials is reported. Data on the effects of several experimental variables on the observed recovery of properties of irradiated steels, the notch ductility of the SL-1 reactor pressure vessel, and the results of neutron environmental survey of the SM-1A reactor are presented. Equipment and procedures for in-reactor experimentation and for postirradiation evaluation of irradiated materials are described. (auth)

16528 (SC-DC-64-346) PREPARATION OF SILICON MATERIAL FOR STUDY OF RADIATION DAMAGE. Final Report. Reinhard K. Gereth (Clevite Corp. Shockley Research Lab., Palo Alto, Calif.). [Feb. 1964]. For Sandia Corp., Albuquerque, N. Mex. Contract [AT(29-1)-789]. 80p.

The preparation of p-type silicon samples suitable for electron and neutron irradiation experiments is described. Starting crystal material, most favorable structure, and contacting procedures are investigated. A new sample holder is developed. Field effect mobility in bulk silicon material and in ion bombarded layers is studied. Growth of silicon crystals by the Dash pedestal method is described. Experimental evidence is presented that permanent radiation damage is observed resulting from a single primary neutron collision in uniform avalanche diodes. The field effect is proposed as a new tool to explore radiation damage in silicon. (auth)

16529 (VDIT-16(4.1)) RADIATION EFFECTS ON SOLID, URANIUM-BASED NUCLEAR FUEL MATERIALS. A Bibliography. W. Uhlmann (Aktiebolaget Atomenergi, Stockholm). Jan. 1964. 38p.

An annotated bibliography of 70 references is presented which is arranged according to the headings general, metallic uranium, alloys, ceramic oxides, carbides and other refractory compounds, and fuel dispersions. Author and subject (coordinate) indexes are included. (D.L.C.)

16530 (AEC-tr-6373) STRENGTHENING OF NEUTRON-IRRADIATED SINGLE CRYSTALS OF COPPER. I. THE STRESS-STRAIN CURVES. Armin Ruckwied. Translated by Lydia Venters (Argonne National Lab., Ill.), from Z. Metallk., Feb. ([1964]). 19p.

A systematic investigation of the dependence of the stress-strain curve of neutron-irradiated copper crystals on irradiation dose, deformation temperature and deformation rate revealed the fact that in different dose ranges there is a different strengthening behavior. These differences are displayed in a differing shape of the shear-stress-slip curves, while the shape of the critical shear stress depending on the irradiation dose fails to manifest such differences. Arranged according to an increasing irradiation dose, four different curve types A1, A2, B, and C were discovered. The dose range, in which the transition from one curve to another occurs, depends on the deformation temperature and deformation rate. For higher deformation temperatures the transitions take place at smaller irradiation doses. Analogous to the nonirradiated crystals, the stress-strain curves of all types roughly may be divided into three regions: a flat initial portion, which despite the very small irradiation dose consists of a flux region with Lüder's band expansion, a steep middle part (II), and a flatter end part (III). Within these strengthening regions, especially in the region II, numerous subregions with somewhat different strengthening behavior are observed. (auth)

16531 (AI-Trans-38) SATURATION PHENOMENA OF DEFECT PRODUCTION BY IRRADIATION AT LOW TEMPERATURES. Werner Schilling (Munich. Technische Hochschule). Translated by Anthony Cornell (Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif.). [1963]. 61p.

The effects of neutron irradiation at low temperature (4.5°K) was investigated for Cu, Ag, Au, Al, Ni, and Pt. The saturation phenomena of the radioinduced lattice defects and Frankel defect pairs were studied. The observed damage rate decreases with the defect concentration already produced, and the saturation concentration depends only a little on the type of radiation. The results were compared with the saturation behaviors predicted from different mechanisms of defect production and recombination. The recombination processes responsible for the decrease of the damage rate are the spontaneous recombination of interstitial atoms and vacancies. In the production of displacement zones, a very high defect density relative to the saturation concentration builds up intermediately, and then is reduced by spontaneous recombination. Closely spaced pairs are formed by low-energy displacement processes. A model is proposed for the defect arrangement produced by a high-energy recoil atom. (D.L.C.)

16532 THE EFFECT OF NEUTRON IRRADIATION UPON THE ELECTRICAL CONDUCTIVITY OF THIN VACUUM-DEPOSITED GERMANIUM FILMS. Russell K. Long (Texas Instruments Inc., Dallas) and Herbert B. Nottage. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 284-9(Jan. 1964).

Electric conductivity data were obtained for germanium films of different thicknesses on glass substrates under exposure to a nuclear reactor environment comprising epithermal neutrons, thermal neutrons, and gamma rays. With an exposure time of 48 hours, a maximum temperature of 120°F, and a cumulative total epithermal neutron flux of 4×10^{16} n/cm^2, the thinnest film showed an erratic increase of conductivity, and the thickest film a marked falling off of conductivity. It is judged that these results include a dependence of the electric conductivity of a film upon the nature of the substrate and the substrate bond. (auth)

16533 MEASUREMENT OF THERMAL CONDUCTIVITY WITH MERCURY CONTACTS. C. D. Bopp. J. Am. Ceram. Soc., 47: 151-2(Mar. 21, 1964).

A method of measuring thermal conductivity that is suitable for use with small specimens near room temperature was developed. The method was used to study radiation effects in ceramic materials, where space limitations and radioactivity precluded the use of large specimens. The specimen is placed between mercury contacts; the upper block is heated electrically, the lower block is held near room temperature, and the thermal conductivity is calculated from the electrical power required to produce a given temperature difference between the blocks. The resistance of the apparatus in series with the specimen is determined by comparing results for specimens of different thickness. (P.C.H.)

16534 HALL EFFECT MEASUREMENT OF RADIATION DAMAGE AND ANNEALING IN Si. Toshikatsu Tanaka and Yoshio Inuishi (Osaka Univ.). J. Phys. Soc. Japan, 19: 167-74(Feb. 1964).

The interactions between several impurities and Frenkel defects introduced by gamma and neutron irradiation at room temperature in Si crystals were investigated mainly by Hall effect measurements. The following conclusions were obtained: (1) Annealing behavior of A center is different from sample to sample. (2) Annealing temperature of A center increases remarkably with increasing A center density or irradiation dosage. (3) Several deep levels, for example, $E_c - 0.4$ ev center are also produced by gamma and neutron irradiation. Their annealing behavior is considerably different from that of A center. (4) The radiation effect and annealing behavior of lifetime show similar features to those of the deep levels stated above. (5) Ni diffused in Si crystals acts as acceptor level ($E_c - 0.34$ ev) and causes negative annealing of deep levels. (auth)

16535 INFLUENCE OF MAGNETIC FIELDS AND X-RAYS ON THE ETCHING OF QUARTZ. Shin-piaw Choong (Nanyang Univ., Singapore). Nature, 201: 910-11(Feb. 29, 1964).

Experiments on the etching of quartz by magnetic fields and x rays showed that neither a strong direct magnetic

field nor an alternating one gives rise to any new kinds of etch figures. In fact, magnetic fields do not produce any effect either on a quartz plate or on a fused silica plate. It was also found that x rays provoke no etching effects similar to those observed in the case of uv radiation. They cannot modify the shape of the characteristic pyramidal etch-figures of a Z-cut surface, nor can they promote the rate of surface dissolution. A hypothesis for the explanation of the etching effects of uv radiation on quartz is proposed. (P.C.H.)

16536 INTERSTITIAL LOOPS IN NEUTRON-IRRADIATED MOLYBDENUM. John D. Meakin (Franklin Inst. Labs., Philadelphia). Nature, 201: 915-16(Feb. 29, 1964).

Experiments were made that established quite definitely that large dislocation loops, produced by neutron irradiation of molybdenum, are interstitial in nature. After irradiation of Mo, crystal sections were jet-machined and electrolytically polished to produce specimens for thin foil microscopy. All sections examined contained large prismatic dislocation loops with a density of $2 \times 10^{13}/cm^3$. Examination of foils prepared parallel to either a (011) plane or a (111) plane showed that the loops tend to lie parallel to (111). Diffraction contrast experiments established that the loops are virtually pure edge in character with a Burgers vector a/2 ⟨111⟩. This was confirmed when a loop moved out of a foil at room temperature, implying that the loops are glissile. (P.C.H.)

16537 EFFECTS OF CHANNELING ON DAMAGE PRODUCTION IN IRON. J. R. Beeler, Jr. and D. G. Besco (General Electric Co., Cincinnati). Phys. Rev., 134: A530-2(Apr. 20, 1964).

The displacement efficiency K(E) for damage production by energetic iron atoms in α iron was computed by simulating complete elastic collision cascades in a bcc atomic array on a high-speed computer. Energies in the range $0.1 \leq E \leq 30$ kev were considered. Above 1 kev, K(E) decreased monotonically as a consequence of progressively more frequent knock-on channeling. Relative to their values in the low-energy, non-channeling range, the energy-dependent displacement efficiency given by this study and that given by Sigmund's theory are in agreement. The extracolated K(E) value at 50 kev was 0.6 that at 1 kev. Damage production by primary knock-ons, per se, was attenuated by quasichanneling. Pure channeling was observed only for higher order knock-ons. In the case of reactor irradiation, the computed K(E) leads to an over-all damage reduction of 35% relative to that predicted by simple cascade theory. This indicates that the ignoration of channeling effects (crystal structure) in simple cascade theory is not totally responsible for its overestimation of damage production by at least a factor of 2. (auth)

16538 EFFECT OF RADIATION ON CONTACT MELTING OF METALS. I. G. Berzina and P. A. Savintsev. p.216-23 of "Poverkhnostnyye Yavleniya v Metallurg. Protsessakh." Moscow, Metallurgizdat, 1963.

Using Cd–Zn pairs as an example, it is shown that contact melting takes place not only in the surface layer but also at the grain boundaries and domains, and at the defects and dislocations near these boundaries. Irradiation of one of the metal pairs, Sn–In, Sn–Bi, Sn–Cd, Bi–Cd, and Zn–In, by neutrons and γ rays sharply increases the relative rate of melting. This effect is attributed to an increase in the number of defects in the crystals as a result of irradiation. As the time of recovery following the irradiation elapses, the associated decrease in the density of defects and dislocations may cause a decline in the melting rate down to values that are lower than those of nonirradiated samples. (Referativnyy zhurnal, metallurgiya, no. 12, 1963)

16539 RADIATSIONNYE EFFEKTY V TVERDYKH TELAKH. (Radiation Effects in Solids). Yu. N. Talanin, ed. Tashkent, Publishing House of Academy of Sciences, 1963. 166p.

Twenty-seven articles are included on nuclear reactions, neutron physics, and radiation effects on physical properties in solids. Separate abstracts have been prepared for seventeen articles. (R.V.J.)

For abstracts of individual papers see: 15993, 16117, 16118, 16119, 16120, 16121, 16122, 16123, 16124, 16125, 16540, 16541, 16542, 16543, 16544, 16545, and 16688.

16540 ON THE EFFECTS OF IONIZING RADIATION ON THE KINETICS OF ISOTHERMAL VITREOUS SELENIUM CRYSTALLIZATION. S. V. Starodubtsev and V. M. Mikhaelyan. p.32-7 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Data are presented on the influence of preliminary γ irradiation on the development and growth of crystallinity in amorphous selenium. The correlations in Co^{60}-irradiated specimens showed that the number of induced defects exceeds the number of nucleate centers, thus indicating that each defect does not become a crystallization center. The strong nonlinear dependence of the number of nucleate centers on radiation intensity and dose indicates a preliminary coagulation of defects. (R.V.J.)

16541 VARIATIONS IN VITREOUS SEMICONDUCTOR CONDUCTIVITY OF ($TlAsSe_2$, $TlAsSe_4$, $As_4Se_3Te_3$ AND As_2Se_2Te) AS FUNCTION OF THE γ RADIATION DOSE. A. N. Bobrova and E. M. Lobanov. p.45-9 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Electric conductivity variations in $TlSe \cdot As_2Se_3$, $Tl_2Sl \cdot As_2Se_3$, $As_2Se \cdot As_2Te_3$, and $2As_2Se_3 \cdot As_2Te_3$ were investigated as functions of integral γ dose. Co^{60} γ-irradiation at 480 r/sec at 32 to 33° increased the electric conductivity. (R.V.J.)

16542 EFFECTS OF γ RADIATION ON THE MECHANICAL PROPERTIES OF VITREOUS SELENIUM. I. A. Domoryad and L. P. Khiznichenko. p.71-4 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

The influence of γ rays (350 r/hr) on elastic deformation of vitreous selenium was studied. Data on radiation effects on internal friction, oscillation periods, and sheer modulus were plotted as functions of temperature. (R.V.J.)

16543 ON THE THEORY OF NUCLEAR RADIATION-INDUCED DIFFUSION ACTIVATION IN SOLIDS. V. M. Lenchenko and T. S. Pugacheva. p.78-82 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

The theory of homogenation in solids, described by J. Dins and J. Vinyard, is extended to the case of incompletely compensated concentration in thermal wedges produced by irradiation. The summed action of all thermal wedges, produced by nuclear emission under isothermal conditions, may produce an effect externally resembling a uniform distribution of admixtures at elevated temperature. Prolonged irradiation equalized the concentration of initially

nonuniform admixture distributions and reduced the life of p-n junctions in solids. An equation was obtained that describes radiation activated diffusion as functions of the heat liberated, thermal conductivity, activation energy, and radiation dose. (R.V.J.)

16544 FAST PARTICLE ENERGY LOSSES ON EXCITATION OF ATOMIC OSCILLATIONS AND DEFECTS FORMED IN SOLIDS. V. M. Lenchenko and T. S. Pugacheva. p.83-95 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Fast particle energy losses related to Coulomb interactions with atomic nuclei in solids were analyzed using three approximations. In the first approximation the "remote" interactions have a small transmitting pulse $(k) < 2\pi/a$ (a is a lattice constant; the wavelength corresponds to transmitted energy $\lambda > a$). In the second, the transmitted energy is $\lambda < a$ or $(k) > 2\pi/a$ and congruent waves cannot propagate in the lattice; so the losses are spent on localized atomic oscillations. The Einstein medium model, in which atoms are bound to their centers and do not interact with each other, is used in the latter case. In the third, collision transmitted energy is larger than the threshold for atom shift, and Frenkel defects are formed. The obtained formulas are in agreement with the Zeitz formula and can be applied in calculations of arbitrary interaction cross sections. (R.V.J.)

16545 EFFECTS OF INTRINSIC FIELD SHIFT IN IRRADIATED SEIGNETTO SALT CRYSTALS. S. V. Starodubtsev and E. V. Peshkov. p.129-34 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

The relation between dielectric parameter variations in weak fields and dielectric hysteresis abnormalities was analyzed and clarified. Hysteresis loop parameters were measured at various temperatures, including critical, after irradiation at 0.4×10^6 r/hr at 5 to 10°C. It was found that the depression of maximums due to irradiation (even in small doses) is influenced by internal field shifts and represents a secondary effect, while the balance of the effect is influenced by crystal defects and admixtures. (R.V.J.)

METEOROLOGY

16546 (AWRE-O-87/63) ELECTRIC, MAGNETIC AND SEISMO-ELECTRIC SIGNALS ARISING FROM THE LOW-ALTITUDE NUCLEAR EXPLOSIONS AT CHRISTMAS ISLAND DURING THE USA DOMINIC SERIES OF 1962. M. W. Alcock, E. E. J. Cogger, and J. A. Russell (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Jan. 1964. 32p.

A telluric measurement station monitored fluctuations in the earth's electric and magnetic fields due to the atmospheric explosions. Ground shock phenomena were also recorded. The telluric and seismo-electric signals from seven shots are presented and discussed. The equipment used is also described. (D.C.W.)

PHYSICS

General

Refer also to abstract 16413.

16547 (AD-416626) THE HYDROMAGNETICS OF A SPHERICAL CONDUCTOR. Technical Report No. 5. G. S. S. Ludford and M. P. Singh (Cornell Univ., Ithaca, N. Y.). July 1963. Contract Nonr-401(46). 4p.

The flow pattern for a sphere of arbitrary conductivity moving through a magnetic field in an arbitrary direction is studied. It is shown that the magnetic disturbance inside and outside the sphere ultimately vanishes. The ultimate flow pattern is also determined when the sphere moves at right angles to the magnetic field. (L.B.S.)

16548 (AERE-R-4494) DIAGRAM EXPRESSIONS USEFUL IN THE THEORY OF FLUIDS. P. Hutchinson (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Feb. 1964. 34p.

Diagrams that occur in a power series expansion in density of the total and direct correlation functions are presented. Diagram expressions are also given for the first six virial coefficients. Values are given for certain of the diagrams for a hard sphere potential; these diagrams are sufficient to calculate numerical values for the first six virial coefficients as predicted by the Hyperchain approximation. (auth)

16549 (ATN-64(9232)-1) ENERGY TRANSFER PROCESSES IN A PARTIALLY IONIZED, TWO-TEMPERATURE GAS. Donald M. Dix (Aerospace Corp., El Segundo, Calif.). Mar. 2, 1964. 62p.

Convective energy transfer between parallel plates at different temperatures is analyzed for partially ionized, nonreacting, monatomic hydrogen in which the electrons may be at a temperature different from that of the heavier species. The gas conditions considered are such that an ion sheath, less than a mean free path in spatial extent, forms on the fully catalytic colder surface. The numerical results obtained indicate that: the gross features of the continuum solution are rather insensitive to the models of sheath and transition regions employed; the energy transfer between ions and electrons due to the electric field external to the sheath is appreciable, particularly in its effect of reducing electron temperature; thermal nonequilibrium effects on total heat transfer are not as great as might be anticipated, due to energy transfer between species by electric fields and the contribution of diffusional processes; and magnetic field effects on total heat transfer are less than the effect on electronic thermal conductivity would indicate and are lessened further by thermal nonequilibrium effects. (auth)

16550 (TID-7688(p.64-7)) DIFFUSION OF RADIOACTIVE GASES THROUGH FILMS. Elmer Nussbaum (Taylor Univ., Upland, Ind.).

The technique used to determine the rates at which radon, tritium, and tritiated methane diffuse through films is described briefly. Results are summarized for radon and tritium diffusing through films of silicone rubbers, plastics (mylar and propylene), and rubber vulcanizates. The temperature dependence of the diffusion is discussed briefly. (D.L.C.)

16551 (TID-20364) A NEW PROCESS OF X-RAY SCATTERING FROM SINGLE CRYSTALS. K. Das Gupta (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). Feb. 1963. Contract AT(04-3)-221. 12p.

At specific crystal setting angles when the recoil-type electrons build up standing waves which resonate with the lattice, a broad diffuse band occurs in the neighborhood of the Laue reflection. A formula was derived for the condition of the resonance of the de Broglie wavelengths of the recoil electrons for the incident ray of wavelength λ_1: $\lambda_1 + \lambda_c = 4(d_{hkl}/n)\sin\theta$, where λ_c = Compton wavelength, d_{hkl} = lattice plant, n = 1, 2, 3 ..., and θ = glancing angle of ray. This formula reduces to the Bragg condition of reflection when $\lambda_1 = \lambda_c$. Experiments were conducted on pure Si single crystals and CuK radiation; the results show that the observed bands are not due to thermal diffuse scattering. (D.L.C.)

16552 (UCRL-11132) PHYSICS DIVISION SEMI-ANNUAL REPORT MAY–OCTOBER 1963. (California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 22, 1963. Contract W-7405-eng-48. 111p.

Research progress on interactions, strange particles, scattering, elementary particles, nuclear and plasma physics, cosmic particles, Dirac monopoles, heavy ion reactions, and resonances is summarized. Development and operation of accelerators, bubble chambers, and data reduction systems are also reported, together with computer operation, development, and programming. (D.C.W.)

16553 (FTD-TT-64-90(p.80-109)) ON THE ADIABATIC INVARIANTS OF MOTION OF A CHARGED PARTICLE IN A STATIONARY HETEROGENEOUS MAGNETIC FIELD. V. D. Plemnex and G. A. Skuridin. (Translation).

On the basis of the classical theory of adiabatic invariants, the conditions of retaining conservation the first, second, and third invariants of the motion of a charged particle in a spatial magnetic system is examined. Since such a motion of a particle in a magnetic field is not strictly conditionally periodic, theoretically there can be a divergence of the adiabatic approximation related to the inseparability of variables in the Hamilton-Jacobi equation. The problem is raised concerning estimation of the accuracies of conserving the second and third invariants in a stationary magnetic field. (auth)

16554 (FTD-TT-64-90(p.128-62)) MOTION OF CHARGED PARTICLES IN A MAGNETIC DIPOLE FIELD WITH ALLOWANCE FOR DISSIPATION OF ENERGY. V. M. Vakhnin, G. A. Skuridin, and I. N. Shvachunov. (Translation).

The problem of the motion of charged particles in a magnetic field in a conservative approximation, while making an allowance for dissipative perturbation for the following three idealized systems: a) a magnetic dipole field in the absence of an outer magnetic field, b) a magnetic dipole in a space having a homogeneous magnetic field parallel to the magnetic dipole field strength vector in its equatorial plane, and c) a magnetic dipole in a space with a homogeneous magnetic field antiparallel to the magnetic dipole field strength vector in its equatorial plane is considered. The problem at the equatorial dipole plane is examined. The motion of charged particles in a magnetic field was analyzed by using the phase plane method in a

conservative approximation, which made it possible to detect a number of critical trajectories and to obtain a qualitative picture of the effect of kinetic energy loss on the shape of the trajectory. These losses were taken into account as small dissipative perturbations of the conservative approximation. (auth)

16555 (UCRL-Trans-1031) OBSERVATION ON THE LIMITS OF DETECTABILITY OF WEAK ALKALI MOLECULAR BEAMS THROUGH IONIZATION ON HOT TUNGSTEN. Friedrich Knauer. Translated by Margaret Little (Univ. of California. Lawrence Radiation Lab., Berkeley), from Z. Physik, 126: 310-18(1949). 11p.

The barely detectable molecular beam, measured as ion current, by the voltage drop across a resistor, in an electric oscillator, and by a galvanometer, was calculated from the assumption that the shot noise and the Johnson noise (Brownian movement) provide a lower limit of detection. The three methods of measurement have the same sensitivity. The attainable sensitivity depends in the same manner on the capacitance and the resistance or the time constants of the input circuits. (auth)

16556 DIRECT OBSERVATION OF FERROELECTRIC DOMAINS IN BARIUM TITANATE BY MEANS OF THE ELECTRON MICROSCOPE. H. Blank and S. Amelinckx (CEN-SCK, Mol, Belg.). Appl. Phys. Letters, 2: 140-2 (Apr. 1, 1963). (EUR-392.e; EURAEC-721)

Thin single crystals of $BaTiO_3$ show ferroelectric domains in transmission electron microscopy. The contrast is produced by Bragg reflection. Suitable oriented domain walls show contrast similar to stacking faults. The geometry of the domains is influenced sensitively by the electron beam. There are noticeable deviations from the (110) orientation of the domain walls. (auth)

16557 A THEORY OF THERMOLUMINESCENCE OF FLUORITE (CaF_2:Y). RADIATIVE RECOMBINATION FROM HIGHLY ASSOCIATED ELECTRON-HOLE PAIRS. J. R. O'Conner (Massachusetts Inst. of Tech., Lexington). Appl. Phys. Letters, 4: 126-8(Apr. 1, 1964).

Fluorite (CaF_2:Y) was irradiated with 2.5-Mev electrons at 77°K for 4 hours, during which time the temperature was increased to 273°K. The resulting spectrum from Y^{3+} capture of electrons and subsequent radiative recombination with holes trapped by F^0 or O^{-1} is shown to be the same as the normally reported thermoluminescence of fluorite. (R.E.U.)

16558 STATIONARY THREAD GLOW DISCHARGE. J. Kracík (Czech. Tech. Univ., Prague). Czech. J. Phys., 13: 895-904(1963).

On the basis of experimental results showing that a uniformly and slowly rotating regular thread is almost quasi-neutral and is difficult to influence by an external magnetic field, relations were derived to explain these phenomena. The angular frequency of rotation of a thread, derived from the equation of continuity, the equation for the momentum, and Poisson's equation, is dependent on the axial macroscopic velocity of negative ions. Conditions were obtained for the distribution of the space charge in the thread. It is seen that quasi-neutrality is only very slightly disturbed. (auth)

16559 CHARACTERISTICS OF A SURFACE CONTACT HALL CURRENT ACCELERATOR. Edward A. Pinsley (United Aircraft Corp., East Hartford, Conn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 58-65(Jan. 1964).

An electric propulsion device is described that utilizes surface contact ion generation followed by space-charge-neutralized, electrostatic ion acceleration in an annular, low-density, Hall current accelerator. Performance analyses and design criteria are presented to illustrate the potentialities of the device for use as an efficient, high-thrust-density engine in the intermediate specific impulse regime. Preliminary experimental data obtained with a laboratory model are presented. (auth)

16560 THE PROPAGATION AND GROWTH OF SONIC DISCONTINUITIES IN MAGNETOHYDRODYNAMICS. G. A. Nariboli (Univ. of Bombay). J. Math. Mech., 12: 141-8 (Mar. 1963).

A scalar equation for the growth of a sonic wave is obtained from magnetohydrodynamic governing differential equations for the formation of a shock from a compressive weak discontinuity. (R.E.U.)

16561 COLLOQUE DE PHYSIQUE NUCLÉAIRE. COMMUNICATIONS PRÉSENTÉES À ORSAY, LES 2, 3 ET 4 MAI 1963. (Colloquium on Nuclear Physics. Papers Presented at Orsay, on May 2, 3, and 4, 1963). J. Phys. (Paris), 24: 769-1072(Nov. 1963).

One hundred and one papers (in French) are included; separate abstracts have been prepared for 99. Two papers were previously abstracted in NSA. (T.F.H.)

For abstracts of individual papers see: 16036, 16320, 16321, 16322, 16323, 16324, 16325, 16613, 16614, 16615, 16616, 16617, 16770, 16771, 16772, 16902, 16963, 16964, 16965, 16966, 16967, 16968, 16969, 16970, 16971, 16972, 16973, 16974, 16975, 16976, 16977, 16978, 16979, 16980, 16981, 16982, 16983, 16984, 16985, 16986, 16987, 16988, 16989, 16990, 16991, 16992, 16993, 16994, 16995, 16996, 16997, 16998, 16999, 17000, 17001, 17002, 17003, 17004, 17005, 17006, 17007, 17008, 17009, 17010, 17011, 17012, 17013, 17014, 17015, 17016, 17017, 17018, 17019, 17020, 17021, 17022, 17023, 17024, 17025, 17026, 17027, 17028, 17029, 17030, 17031, 17032, 17033, 17034, 17035, 17036, 17037, 17038, 17039, 17040, 17041, 17042, 17043, 17044, and 17045.

16562 GRADIENT-ELASTIC TENSOR OF ALKALI HALIDE CRYSTALS. Yuh Fukai (Tokyo Univ.). J. Phys. Soc. Japan, 19: 175-87(Feb. 1964).

The origin of an electric field gradient due to strains in alkali halide crystals is studied from the experimental determination of gradient-elastic tensors. Tensors for ^{23}Na, ^{35}Cl, ^{81}Br and ^{127}I in a series of crystals are determined from the quadrupolar broadening of resonance lines due to solute ions, using lattice distortion derived from lattice parameter changes. Results are interpreted by the theory that takes account of the contribution from valence electrons, besides point charge arrays, and gives an expression of a gradient-elastic tensor in terms of an anti-shielding factor, overlap integrals and a degree of covalency. An excellent agreement is found between the theoretical and experimental tensor values for ^{23}Na in NaCl, for which both theory and experiment are least ambiguous. For other crystals, a degree of covalency is tentatively estimated, with reasonable results. (auth)

16563 NUCLEAR MAGNETIC RELAXATION IN Sc AND La METALS. Yoshika Masuda (Kobe Univ., Japan). J. Phys. Soc. Japan, 19: 239-41(Feb. 1964).

A pulse method was used to measure the nuclear spin-lattice relaxation time and spin-spin relaxation time for ^{45}Sc and ^{139}La in the respective metals at 1.5 to 77°K. (R.E.U.)

16564 HYDROMAGNETIC STABILITY AT A FLUID VELOCITY DISCONTINUITY BETWEEN COMPRESSIBLE FLUIDS. J. A. Fejer (Southwest Center for Advanced Studies, Dallas). Phys. Fluids, 7: 499-503(Apr. 1964).

Formal conditions are derived for the stability of a velocity discontinuity at a plane interface between two perfectly conducting, inviscid, compressible fluids, in the presence of uniform magnetic fields. Certain special cases, in which the stability conditions can be simplified, are discussed in detail. Previous results for incompressible fluids are rederived and it is shown that the introduction of a slight compressibility always reduces the stabilizing effect of magnetic fields. It is further shown that in two special cases the magnetic field required to stabilize an interface continues to increase with the introduction of more compressibility until it reaches a limiting value that is about twice as large as the value appropriate to incompressible fluids. (auth)

16565 MICROWAVE ATTENUATION BY SHOCKED HEATED AIR. M. Dvir and W. Low (Hebrew Univ., Jerusalem). Phys. Fluids, 7: 578-86(Apr. 1964).

The microwave attenuation of air in Mach range 8 to 12 is investigated at initial pressures of 5 mm Hg. It is shown that the experimental peak attenuation is larger than given by conventional theory, and that the time dependence of the attenuation curve gives important information regarding the build-up of the ionization as a function of time, the contact surface and the zone behind it. It is found that the microwave attenuation rises approximately linearly as a function of time to its peak value. The testing time is shorter than that predicted from ideal shock theory but sufficient to establish equilibrium. The electron density changes abruptly upon arrival of the driver gas. However, an appreciable electron density exists over a large region behind the contact surface indicating strong interface mixing. It is also shown that the nature of the surface of the shock tube influences the peak attenuation and the time dependence of this attenuation. (auth)

16566 X-RAY EMISSION FROM EXPLODING WIRES. Ihor M. Vitkovitsky (Naval Research Lab., Washington, D. C.). Phys. Fluids, 7: 612-13(Apr. 1964).

It is shown that the soft x radiation emitted from hollow exploding wires emanates from a region of the exploding-wire plasma whose electron temperature is a few kev. The results were obtained from hollow aluminum cylinders that were exploded using a low-inductance storage system capable of operation at very high voltage (400 kev). (R.E.U.)

16567 SYMMETRY RELATION IN RELAXATION DISPERSIONS. P. H. Fang (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev., 134: A296-8(Apr. 20, 1964).

A theorem on the relation between the symmetry of the dispersion function of the frequency variable and the distribution function of the relaxation time variable is proved. Some applications of this theorem are discussed. (auth)

16568 TRIPLET CORRELATIONS IN HARD SPHERES. B. J. Alder (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. Letters, 12: 317-19(Mar. 23, 1964).

The triplet distribution function for hard spheres is evaluated over the entire density range by superposition approximation for determining thermodynamic properties in many-body problems. The accuracy of the superposition approximation method is discussed and tables for pair and triplet distribution functions and particle separations are given. (L.B.S.)

16569 ON THE THEORY OF CLASSICAL FLUIDS-III. Loup Verlet (Laboratoire de Physique Theorique, Orsay, France). Physica, 30: 95-104(Jan. 1964).

Higher order approximations to the integral equations for the pair distribution of classical fluids are derived and discussed. The integral equations that result when the next term in the Taylor's expansion is taken into account in the Percus-Yevick and the Hypernetted chain integral equations, called PY2 and HNC2, are derived. The PY2 and HNC2 equations are applied to models of hard rod, hard square, and hard cube gases. The first six virial coefficients for the PY2 equation and the first five virial coefficients for the HNC2 equation are calculated. (C.E.S.)

16570 THE PERFECT RELATIVISTIC GAS. T. Y. Thomas (Indiana Univ., Bloomington). Proc. Natl. Acad. Sci. U. S., 51: 363-7(Mar. 15, 1964).

A system of equations is obtained by direct extension of nonlinear differential equations for a perfect gas (devoid of viscosity and thermal conductivity) in general relativity theory. The propagation of sonic disturbances in the gas is discussed as an illustration. (R.E.U.)

16571 MATERIAL MOMENTUM-ENERGY TENSORS AND THE CALCULUS OF VARIATIONS. Dominic G. B. Edelen (RAND Corp., Santa Monica, Calif.). Proc. Natl. Acad. Sci. U. S., 51: 367-72(Apr. 1964).

Intrinsic limitations imposed on the Einstein theory of general relativity by the requirement that the field equations be obtained from a homogeneous variational principle are demonstrated using momentum-energy tensors and the calculus of variations. (R.E.U.)

16572 ON THE MUTUAL CANCELLATION OF CLUSTER INTEGRALS IN MAYER'S FUGACITY SERIES. H. N. V. Temperley (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London), 83: 3-16(Jan. 1964).

Theorems are proved for each of two models representing purely repulsive interactions, the Gaussian and the rigid line. In both cases the fugacity series is studied by starting with the complete diagram of l points connected by $\frac{1}{2}l(l-1)$ lines. For the Gaussian model, it is proved rigorously that the cluster integral corresponding to any diagram can be expressed as a product, each disjoint set of lines in the complementary diagram contributing one factor. The result for the rigid-line model is that any cluster integral can be expressed as a sum, each disjoint set of lines in the complementary diagram contributing a term, with corresponding results for the rigid-square and rigid-cube models. These results enable the consequences of the Gaussian model to be worked out almost completely, and provide some justification for approximate treatments that neglect all but the more open diagrams. The rigid-square model is more difficult analytically, and only a few preliminary deductions were made. (auth)

16573 A CALCULATION OF THE DENSITY OF ELECTRON STATES AND DEGREE OF LOCALIZATION IN A ONE-DIMENSIONAL LIQUID MODEL. R. E. Borland and N. F. Bird (National Physical Lab., Teddington, Eng.). Proc. Phys. Soc. (London), 83: 23-9(Jan. 1964).

An integral equation for the phase density function is solved numerically to give the density of electron states and the average logarithmic decay of the envelope of the wave functions in a simple one-dimensional liquid model. The results are presented graphically to show the effect of varying amounts of disorder. (auth)

16574 CALORIMETRIC DETERMINATION OF THE ENERGY DIFFERENCE BETWEEN THE FIRST EXCITED STATE AND THE GROUND STATE IN CERIUM MAGNESIUM NITRATE. C. A. Bailey (Oxford Univ.). Proc. Phys. Soc. (London), 83: 369-74(Mar. 1964).

The specific heats of cerium magnesium nitrate and

lanthanum magnesium nitrate were measured in the temperature range 2 to 25°K. These measurements show that there is an anomalous contribution to the specific heat of the cerium salt of the Schottky type with its maximum at 14.0 ± 0.5°K. This corresponds to an energy splitting Δ/k of 34 ± 1.5 deg K between the first excited state and the ground state. (auth)

16575 SPECTRA OF PdH AND PdD. A. Lagerqvist, H. Neuhaus, and R. Scullman (Univ. of Stockholm). Proc. Phys. Soc. (London), 83: 498-9(Mar. 1964).

A rotational analysis is presented of the 4048.6 Å band of PdD observed in absorption in a King furnace at 2800°C. Spectra of PdH were also observed. (R.E.U.)

16576 ELECTRON DIFFRACTION PATTERNS FROM SOLID DEUTERIUM. A. E. Curzon and A. T. Pawlowicz (Imperial Coll. of Science and Tech., London). Proc. Phys. Soc. (London), 83: 499-501(Mar. 1964).

The results of electron diffraction studies on deuterium at about 12°K are described. The diffraction patterns differ from x-ray and neutron diffraction patterns. (auth)

16577 LUMINESCENCE IN SOLIDS. G. F. J. Garlick (Univ. of Hull, Eng.). Sci. Progr. (London), 52: 3-25(Jan. 1964).

The basic processes in luminescence, conditions for emission at luminescence centers and detailed nature of the latter, and mechanics of electron trapping and those of electroluminescence are discussed. References are also given to other aspects of current research in the subject such as cathodoluminescence. (P.C.H.)

16578 THEORETICAL ELECTROMAGNETISM. R. H. Atkin. New York, John Wiley and Sons, Inc., 1962. 265p.

Electrostatics, statistical problems in magnetostatics solved by $\nabla^2 V = 0$, electric currents, electromagnetism, Maxwell's field equations, and the special theory of relativity are discussed. (R.E.U.)

16579 SINGULAR PROPERTIES OF FLOW PATTERNS AT SMALL R_m. G. S. S. Ludford (Cornell Univ., Ithaca, N. Y.). p.61-7 of "Relativistic Fluid Mechanics and Magnetohydrodynamics." New York, Academic Press, Inc., 1963.

A review is presented of some magnetohydrodynamic problems associated with the flow of a slightly conducting fluid past a body in a plane geometry. The magnetic Reynolds number R_m is proportional to the conductivity and is therefore small. Cases are considered for small and large $N(N = \mu^2 h^2 a\sigma/\rho_0 U_0$; μ = permeability, σ = conductivity, ρ_0 = density, U_0 = free-stream velocity, h = representative magnetic intensity, and a = representative length). 15 references. (R.E.U.)

16580 A THIRD COMPILATION OF U. S. IGY-IGC ROCKET PROGRAM RESULTS. John C. Truesdale and Ann Wagoner, comps. (National Academy of Sciences). IGY Rocket Report Number 7. Apr. 1963. 382p. Available from National Academy of Sciences, Washington, D. C. $3.00.

Results of research rocket experiments conducted as part of the United States program for IGY (1957-58) and IGC (1959) as well as some important 1960 rocket launch data are presented in the 40 papers. Atmospheric physics and composition, terrestrial magnetism, ionospheric physics, solar physics, and astrophysics are discussed. The papers were previously published in various journals. (R.E.U.)

16581 ION BEAM NEUTRAL COMPONENT DETERMINATIONS BY RESONANCE RADIATION ABSORPTION. R. K. Cole (Univ. of California, Los Angeles), D. F. Hall, R. F. Kemp, and J. M. Sellen, Jr. New York, American Inst. of Aeronautics and Astronautics, 1964. Preprint 64-9, 55p, $1.00. (CONF-392-3)

From Aerospace Sciences Meeting, New York, Jan. 1964.

The detection of neutral atoms in an ion engine exhaust by resonance absorption techniques is proposed. A lamp-detector system is described. (R.E.U.)

16582 OPTIMIZATION OF ION ENGINE CONTROL SYSTEMS FOR SYNCHRONOUS SATELLITES. J. H. Molitor and M. H. Kaplan (Hughes Research Labs., Malibu, Calif.). 31p. (CONF-97-24)

From American Institute of Aeronautics and Astronautics, Conference, Los Angeles, June 1963.

Results are presented of a study concerning the magnitude and nature of the major forces, e.g., solar-lunar and earth's triaxiality, which perturb the orbit of a synchronous satellite. The optimum design and mode of operation of an ion propulsion station-keeping system is determined. A comparison of the system weight for both pulsed mode and continuous mode operation is presented that shows the distinct advantage of a continuous correction with a relatively low thrust ion engine. In addition, the trade-offs between the critical mission and system parameters are provided from which the capabilities and requirements of both the attitude control and station-keeping systems can be determined for application over a wide range of satellite weights. (auth)

Accelerators

16583 (BNL-7534) PROCEEDINGS OF THE 1963 SUMMER STUDY ON STORAGE RINGS, ACCELERATORS AND EXPERIMENTATION AT SUPER-HIGH ENERGIES, JUNE 10 TO JULY 19, 1963. J. W. Bittner, ed. (Brookhaven National Lab., Upton, N. Y.). Contract AT-30-2-GEN-16. 483p.

Separate abstracts were prepared for all of the 33 papers presented. (R.E.U.)

For abstracts of individual papers see: 16293, 16294, 16295, 16584, 16585, 16586, 16587, 16588, 16589, 16590, 16591, 16592, 16593, 16594, 16595, 16596, 16597, 16598, 16599, 16600, 16001, 16002, 16603, 16604, 16728, 16729, 16747, 16748, 16749, 16750, 16751, 16752, and 16753.

16584 (BNL-7534(p.39-48)) ON THE EXPERIMENTAL PROGRAMS FOR A SUPER-HIGH-ENERGY (1000-Bev) ACCELERATOR, AND FOR A HIGH-INTENSITY (30-Bev) ACCELERATOR. R. H. Dalitz (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies).

The possible uses of a 1000-Bev accelerator to investigate new particle states, particle structure, large-impact-parameter collisions, and for high-energy secondary beam production are described. The advantages of a high-intensity (10^{13} protons per pulse) 30-Bev AGS accelerator are discussed. (R.E.U.)

16585 (BNL-7534(p.128-70)) CERN STUDIES ON PROTON STORAGE RINGS. A. Schoch (European Organization for Nuclear Research, Geneva).

The history of devices for colliding-beam experiments is discussed. Interaction rates, the filling process, and particle density limits for proton storage rings are discussed. The lifetimes of stored beams and phenomena that limit the lifetimes are discussed. Design problems for concentric storage ring systems with several beam intersections are considered, and an experimental setup

for studying proton-proton colliding-beam interactions is described. (R.E.U.)

16586 (BNL-7534(p.171-208)) THE ITALIAN STORAGE RINGS. B. F. Touschek (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati).

A report is presented of work done with "AdA", a storage ring for 250-Mev positrons and electrons located at the linear accelerator laboratory at Orsay. An outline of the state of the project "Adone", a 1500-Mev positron-electron storage ring under construction at Frascati, Italy, is given. (R.E.U.)

16587 (BNL-7534(p.209-27)) STORAGE-RING WORK AT STANFORD. G. K. O'Neill (Princeton Univ., N. J.).

The Princeton-Stanford storage-ring electron-electron collision experiment is described. The vacuum system design and operation is discussed. (R.E.U.)

16588 (BNL-7534(p.228-9)) BEAM SURVIVAL IN THE COSMOTRON. J. G. Cottingham (Brookhaven National Lab., Upton, N. Y.).

Reports are given of the decay rate for 1-Bev coasting beams in the Cosmotron. The intensity decay was found to be exponential and aperture-dependent, and it was concluded that the loss mechanism is Coulomb scattering. (R.E.U.)

16589 (BNL-7534(p.230-5)) INITIAL TESTS OF PROTON STORAGE IN THE AGS. J. W. Bittner (Brookhaven National Lab., Upton, N. Y.).

Some problems associated with operation of AGS as a storage ring for proton pulses are discussed. Modifications to the low-level r-f circuit to produce a harmonic jump are shown. (R.E.U.)

16590 (BNL-7534(p.236-7)) SOME THOUGHTS ON STORAGE RINGS. E. H. S. Burhop (European Organization for Nuclear Research, Geneva).

The role of storage rings in future high-energy-physics research is discussed. (R.E.U.)

16591 (BNL-7534(p.253-76)) PHYSICS TO BE DONE WITH COLLIDING BEAMS. L. W. Jones (Michigan. Univ., Ann Arbor).

Some experiments expected to become accessible with storage rings are discussed. Very small- and large-angle elastic p-p experiments are described. Colliding-beam peripheral-production, intermediate boson detection, and 4π solid-angle experiments are described. A table of parameters for colliding beams with the 30-Bev AGS is given. (R.E.U.)

16592 (BNL-7534(p.277-307)) PROBLEMS OF EXPERIMENTATION WITH COLLIDING PROTON BEAMS. E. H. S. Burhop (European Organization for Nuclear Research, Geneva).

Experiments involving high-energy p-p interactions at high momentum transfer for colliding proton beams are discussed. Particular emphasis is placed on the importance of the way in which storage-ring experiments will be carried out. Momentum and angular distributions of secondary particles from p-p collisions and experimental techniques for particle measurement and identification are discussed. (R.E.U.)

16593 (BNL-7534(p.324-67)) ON INTENSITY LIMITATIONS IMPOSED BY TRANSVERSE SPACE-CHARGE EFFECTS IN CIRCULAR PARTICLE ACCELERATORS. L. J. Laslett (California. Univ., [Livermore]. Lawrence Radiation Lab.).

A discussion is presented of transverse space-charge effects on axial stability in a circular accelerator. Field coefficients that represent the image effects in certain geometrical configurations are given. Numerical examples are presented for a proton synchrotron of 120-meter radius (AGS-type for 30 Bev). (R.E.U.)

16594 (BNL-7534(p.368-74)) VERTICAL INSTABILITIES IN ELECTRON STORAGE RINGS. PART I. COHERENT VERTICAL INSTABILITIES IN THE MURA 50-Mev ELECTRON ACCELERATOR. F. E. Mills (Midwestern Universities Research Assn., Stoughton, Wis.).

Beam stacking investigations for energies of 15 to 45 Mev are reported for the MURA electron accelerator. Instabilities causing loss of stacked beam were studied. (R.E.U.)

16595 (BNL-7534(p.375-8)) VERTICAL INSTABILITIES IN ELECTRON STORAGE RINGS. PART II. SOME EXPERIMENTAL RESULTS FROM THE STANFORD ELECTRON STORAGE RING. G. K. O'Neill (Princeton Univ., N. J.).

Vertical instability was studied in the 140-cm radius Stanford storage ring at 310 Mev from observations of the beam cross section during stacking. (R.E.U.)

16596 (BNL-7534(p.379-84)) AN ALTERNATE ACTIVITY TO STORAGE RINGS—HIGH-INTENSITY AGS. L. M. Lederman (Columbia Univ., New York).

The advantages and feasibility of increasing the intensity of the AGS by a factor of 50 to 100 are discussed. Secondary beams that would be made available are described. (R.E.U.)

16597 (BNL-7534(p.385-91)) A POSSIBLE HIGH-INTENSITY, HIGH-ENERGY ACCELERATOR. M. Schwartz (Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Labs.).

The advantages and technical and economic practicality of a 100-Bev accelerator with beam intensity of 10^{14} to 10^{15} protons per second are discussed. Injection of the entire beam from a FFAG-type accelerator into a high-energy AGS-type accelerator is suggested. (R.E.U.)

16598 (BNL-7534(p.392-8)) STUDIES OF RADIOACTIVITY AT HIGH ENERGIES. J. B. Cumming (Brookhaven National Lab., Upton, N. Y.).

Problems connected with radioisotope production in components of, and shielding materials for, high-intensity, high-energy accelerators are discussed. (R.E.U.)

16599 (BNL-7534(p.399-405)) ACCELERATORS WITH NONLINEAR FOCUSING—THE ORLOV PROPOSAL. E. D. Courant (Brookhaven National Lab., Upton, N. Y.).

A study was made of a principle suggested by Y. F. Orlov to achieve the equivalent of alternating-gradient focusing in an azimuthally uniform field. (R.E.U.)

16600 (BNL-7534(p.406-13)) EXPERIMENTS WITH NEUTRON-GAS TARGETS. A. I. Yavin (Illinois. Univ., Urbana).

The feasibility and advisability of constructing a high-neutron-density reactor near an accelerator to provide a neutron-gas target for "direct" observation of $\bar{p}$-n, n-n, π-n, $e^{\pm}$-n, and K-n interactions are discussed. The neutron-gas target is an attempt to eliminate deuteron targets where the presence of the proton must be considered. The use of a pulsed reactor with a properly matched synchrotron is suggested. (R.E.U.)

16601 (BNL-7534(p.414-16)) A METHOD FOR INJECTION INTO BETATRON PHASE SPACE. J. P. Blewett (Brookhaven National Lab., Upton, N. Y.).

A method is described for beam injection and stacking in storage rings that depends on the simultaneous existence

of two equilibrium orbits in the same magnet structure. (R.E.U.)

16602 (BNL-7534(p.417-47)) REPORT ON SUPERCONDUCTING MATERIALS AND POSSIBLE APPLICATIONS. P. G. Kruger (Illinois. Univ., Urbana).

The applications of superconductors for 30-Bev proton storage rings and a 1000-Bev proton accelerator are discussed. Some properties of Nb–Zr and Nb_3–Sn are discussed, and the NRC, GE, and RCA processes for producing Nb_3–Sn strips are described. (R.E.U.)

16603 (BNL-7534(p.448)) RECENT PROGRESS IN THE BROOKHAVEN COIL CONSTRUCTION PROGRAM. W. B. Sampson (Brookhaven National Lab., Upton, N. Y.).

Progress in construction of superconducting solenoids capable of 52 kgauss at 63 amp is reported. (R.E.U.)

16604 (BNL-7534(p.449-77)) MAGNETIC-FIELD SHAPING BY SUPERCONDUCTING SURFACES. G. del Castillo (Midwestern Universities Research Assn., Stoughton, Wis.).

Preliminary results on possible uses of superconductors for shaping of magnetic fields are reported. FFAG-type fields and bending and focusing magnets are discussed. (R.E.U.)

16605 (CERN-64-7) UN NOUVEAU SYSTEME D'ALARME GENERAL. (A New General Alarm System). F. Hoffmann (European Organization for Nuclear Research, Geneva). Jan. 31, 1964. 36p.

The general alarm system at CERN which can be used for very simple control systems with only one lock and for very complex equipment such as the high-frequency system with chains of 22 locks is described. The principles of the system are given and illustrated. Each surveillance contact is joined to an alarm unit containing the lock circuit and signaling the contact state. The chain thus formed ends in an output unit, which signals if the sequence is complete and controls the complete relay sequence permitting equipment engaging. A common alarm block furnishes intermittent voltage for blinking the location lights on the control panel. Detailed circuits of each element are given. (J.S.R.)

16606 (CERN-64-13(Vol.I)) PROCEEDINGS OF THE 1964 EASTER SCHOOL FOR PHYSICISTS USING THE CERN PROTON SYNCHROTRON AND SYNCHRO-CYCLOTRON, HERCEG-NOVI, MAY 18-31, 1964. (European Organization for Nuclear Research, Geneva). Feb. 28, 1964. 195p. (In English and French)

Separate abstracts were prepared for the six sections of the report. (D.C.W.)

For abstracts of individual sections see: 16296, 16408, 16409, 16410, 16411, and 16754.

16607 (CERN-64-13(Vol.II)) PROCEEDINGS OF THE 1964 EASTER SCHOOL FOR PHYSICISTS USING THE CERN PROTON SYNCHROTRON AND SYNCHRO-CYCLOTRON, HERCEG-NOVI, MAY 18-31, 1964. (European Organization for Nuclear Research, Geneva). Feb. 28, 1964. 203p.

Separate abstracts were prepared for the three sections of the report. (D.C.W.)

For abstracts of individual sections see: 16755, 16756, and 16757.

16608 (CERN-64-13(Vol.III)) PROCEEDINGS OF THE 1964 EASTER SCHOOL FOR PHYSICISTS USING THE CERN PROTON SYNCHROTRON AND SYNCHRO-CYCLOTRON, HERCEG-NOVI, MAY 18-31, 1964. (European Organization for Nuclear Research, Geneva). Feb. 28, 1964. 117p.

Separate abstracts were prepared for the two sections of the report. (D.C.W.)

For abstracts of individual sections see: 16758 and 16759.

16609 (LAL-1081) PROJET D'UN ANNEAU DE STOCKAGE A ORSAY POUR ELECTRONS ET POSITRONS D'UNE ENERGIE MAXIMALE DE 450 Mev. (Project of a Storage Ring at Orsay for Electrons and Positrons of a Maximum Energy of 450 Mev). (Paris. Université, Orsay. École Normale Supérieure. Laboratoire de l'Accélerateur Lineaire). Sept. 1963. 19p.

The storage ring under construction at Orsay is described. Injection and beam characteristics are discussed. Ring and injection system parameters are included, together with beam characteristics calculated for 250 and 450 Mev. (D.C.W.)

16610 (LNF-63/72) STUDIO DEL DEFLETTORE DI ADONE. Nota interna: n. 220. (Study of a Deflector for Adone. Note No. 220). A. Massarotti, M. Puglisi, and F. Tazzioli (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Nov. 28, 1963. 31p.

The pre-design requirements for the Adone deflector are reported. The structure proposed to fulfill these design criteria is then described. The criteria for the selection of the conductor profile are based on the realization of the best compromise between the necessity for a useful zone of the magnetic field in the section between the conductors and the necessity of obtaining the field required for the deflection with the minimum current possible. The criteria chosen are reported. The deflector design and model measurements are given. A block diagram of the complete installation is given and discussed. (J.S.R.)

16611 (ZFK-PHA-5) MESSUNG DER ENERGIE UND ENERGIEVERTEILUNG EINES ZYKLOTRONSTRAHLES. (Measurement of Energy and Energy Distribution of Cyclotron Rays). Frank Baldeweg and Karl Schlott (Germany. Zentralinstitut für Kernphysik, Dresden). Aug. 1961. 11p.

A system for measuring the energy and energy distribution of cyclotron beams by deflection in an electrostatic crossfield is described. For proton beams with energies up to 10 Mev, an accuracy of 1% can be obtained. (D.C.W.)

16612 EQUATIONS OF MOTION OF PARTICLE IN CIRCULAR ACCELERATOR WITH GENERAL FIELD. Z. Sedláček (Inst. of Vacuum Electronics, Czechoslovak Academy of Sciences, Prague). Czech. J. Phys., 14: 14-20(1964).

Lagrange equations of motion are derived for a particle in a circular accelerator with arbitrarily spatially variable guiding magnetic field, describing the motion of a particle by means of dimensionless deviations of the particle from a circle as the reference curve. Linearized equations of motion (so-called equations of perturbations used in stability investigations according to the Ljapunov method of the first approximation) are also derived. The equations are given in the closed form and are thus quite exact. (auth)

16613 SOME REFLECTIONS ON THE PRESENT EVOLUTION OF PARTICLE ACCELERATORS. Francis Fer (Institut du Radium, Orsay, France). J. Phys. (Paris), 24: 792-800(Nov. 1963). (In French)

A review is given of the characteristics of proton synchrotrons, isochronous cyclotrons, storage rings, and linear accelerators, with emphasis on focusing, targets, domains of operation, accelerating properties, and state-of-the-art. (T.F.H.)

16614 PULSATION BY HIGH-SPEED MODULATION OF A BEAM OF 150-Kev DEUTERONS. M. Bethery and M. Lott (CEN, Fontenay-aux-Roses, France). J. Phys. (Paris), 24: 1010-11(Nov. 1963). (In French)

We have developed a high-speed pulsation device for a 150-kev deuteron beam from an accelerator. The frequency repetition of the pulses is 5 Mc and the average current reaches 7% of the continuous current. The neutron pulse from the (D, T) nuclear reaction has a 1.5×10^{-9} second duration at half-height. (auth)

16615 A SOURCE OF LITHIUM IONS. B. Delaunay-Olkowsky, L. Bianchi, J. P. Meurgues, and J. Petres (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 1012-13(Nov. 1963). (In French)

An ion source for electrostatic accelerators has been built. This source has been used with a 5-Mev Van de Graaff, with 8 μA of Li^{6+} at 4.5 Mev. On test we have obtained 1.2 mA of Li^{7+}. (auth)

16616 INSTALLATION OF 12-Mev H.V.E.C. TANDEM AT SACLAY. B. Delaunay-Olkowsky (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 1014-16(Nov. 1963). (In French)

A brief summary of the installation of a tandem Van de Graaff and its helium injection system is given. The maximum current for the maximum energy range, with protons, has been studied. The results are: 2 μa at 1 Mev; 4.5 μa at 6 Mev; 1 μa at 12 Mev; and 8.5 μa at 6 Mev. (auth)

16617 THE POLARIZED DEUTERONS OF THE SACLAY CYCLOTRON AND THEIR USE IN (d,d) SCATTERING AND (d,p) REACTIONS. R. Beurtey, R. Chaminade, A. Falcoz, R. Maillard, T. Mikumo, A. Papineau, L. Schecter, and J. Thirion (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 1038-44(Nov. 1963). (In French)

The state of the polarized deuteron source at the Saclay cyclotron is described. In addition to a maximum vector polarization $\pm^2/_3$ (reversible), we can also obtain various mixtures of vector and tensor polarization. The asymmetries obtained with such polarized beams are given for several (d,p) reactions. (auth)

16618 THE ARRANGEMENT OF MEASURING PROBES FOR ADJUSTING THE CYCLOTRON BEAM. T. Fukátko, M. Krivánek, and Z. Sebek (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Kernenergie, 7: 103-5(Feb. 1964). (In German)

An arrangement of measuring probes along the ion tube of the cyclotron is described. Their purpose is to maintain and regulate the path of particles emitted from the accelerator into the target chamber. A geometric adjustment of the ion tube and the focussing lenses is made possible by means of these probes. (OTS)

16619 ARGONNE NATIONAL LABORATORY EXPERIMENTS AT THE ZGS. Nucl. Energy, 73-5(Mar. 1964).

Descriptions are given of the first six experiments selected for the Zero Gradient Synchrotron at Argonne. (P.C.H.)

16620 USKORITELI. VYPUSK V. SBORNIK STATEI. (Accelerators. Issue 5. Collection of Articles). G. A. Tyagunov. Moscow, Gosatomizdat, 1963. 191p.

Articles are included on linear accelerator field self-consistency, critical beam current in a buncher, particle dynamics in an injector-buncher, power balance in electron acceleration, and characteristics of accelerator with inverse power input. Experimental data are given on the performance of an experimental accelerator (U-10) and a magnetron with selective frequency. (R.V.J.)

16621 BETATRON WITH A TOROIDAL MAGNETIC FIELD. G. I. Dimov and G. P. Fomenko. p.91-9 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

The motion of electrons in a betatron with an additional toroidal magnetic field directed along the orbit was studied approximately. On the basis of this study a conclusion was drawn on the possibility of stable acceleration of particles in such a betatron; for an efficient injection a large rate of increase of the toroidal magnetic field is then required. It is maintained that, due to the increase of focusing, the intensity of accelerated particles in the betatron considered is higher by 3–4 orders than in the conventional betatron and is determined chiefly by the magnitude and rate of increase of the toroidal magnetic field. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16622 ON THE MECHANISM OF ELECTRON CAPTURE, WITHOUT OSCILLATIONS, INTO ACCELERATION IN A BETATRON. B. V. Okulov. p.124-6 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

The problem of controlling the injection current, necessary for the realization of the capture mechanism without oscillations was examined. It is shown that such a control can be realized with the aid of an inflector (by the choice of the amplitude and phase of the tension pulse). (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16623 EFFECT OF THE SECTOR ANGLE DYNAMICS ON THE OPERATION OF A WEAK FOCUSING ACCELERATOR HAVING 4 RECTILINEAR SECTIONS. Yu. K. Petrov. p.149-51 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

In a weak focusing accelerator with 4 rectilinear gaps the equilibrium orbit distortion due to the decrease of the effective angles of the magnetic sectors (quadrants) during the acceleration process was studied. The said decrease is caused by eddy currents and remanent induction (for weak fields) as well as by magnet saturation. (Referativnyy Zhurnal, Fizika, No. 1, 1963).

16624 ON THE SYNCHRONIZATION OF A BETATRON-INJECTOR WITH A SYNCHROTRON. G. I. Dimov. p.152-3 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

A new variant is proposed for synchronizing a betatron-injector with a synchrotron. It is not required to stabilize the betatron excitation current. The excitation currents of the betatron and of the synchrotron are arranged to be in such a phase relationship that the moment of electron injection into the synchrotron should coincide with the maximum of the magnetic field of the betatron; the betatron extractor is then controlled by a signal from a permalloy transmitter placed in the field of the synchrotron. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16625 ELECTRON COMPONENT OF BETATRON RADIATION. E. A. Vasil'ev and B. A. Kononov. p.167-70 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

It is shown that the experimentally observed second maximum in the spatial distribution of betatron radiation is due to electrons having a continuous energy spectrum and arising upon the passage of the main beam of γ rays through the wall of the vacuum chamber. Attention is drawn to the possible errors when ignoring these electrons. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16626 APPARATUS FOR ABSOLUTE AND RELATIVE MEASUREMENTS OF THE MAGNETIC FIELD (ENERGY) IN a. c. OPERATED ACCELERATORS. V. S. Shirchenko. p.220-1 of "Elektronnyi Uskoriteli." Tomsk, SSR, Tomsk State Univ., 1961.

An electron tube arrangement employed on a synchrotron for measurements of the magnetic field (and energy) by the method of the universal ferrometer is described. The arrangement constitutes a controlled key with a resistance ratio (in the unlocked and locked states) $>10^6$. The basic element thereof is a switched d-c amplifier with a 100% negative feedback. For input signals up to ±50 volts the key resistance is 3 ohms in the locked state, and 50 megohms in the unlocked state. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

16627 APPARATUS FOR BENDING BEAMS OF CHARGED PARTICLES. (to Varian Associates). British Patent 949,171. Feb. 12, 1964. Priority date Mar. 9, 1959, United States.

An efficient beam scanner assembly was developed. An apparatus for bending a beam of charged particles of different energies, so that the beam after bending has a particle-energy gradient across it, is described. The apparatus consists of a bending magnet with pole pieces disposed on opposite sides of the beam. The magnet was arranged to apply to the particles in the beam magnetic forces such that particles of greater energy travel along longer trajectories between the pole pieces than particles of lower energy and that particles of all energies are deflected through approximately the same angle. (M.C.G.)

16628 APPARATUS FOR SCANNING A SURFACE WITH A BEAM OF CHARGED PARTICLES. (to Varian Associates). British Patent 949,172. Feb. 12, 1964. Priority date Mar. 9, 1959, United States.

An apparatus was designed for scanning a surface with a beam of charged particles. It consists of an electromagnet and a means for applying a time-varying current to the windings of the electromagnet to generate a magnetic field between pole faces of the electromagnet. The pole faces are so shaped that there is a flux density gradient in the gap between the pole faces and means for directing a beam of charged particles, with a particle energy gradient across it, through the gap in such a manner that particles of greater energy pass through a portion of the magnetic field where the flux density is greater than the portion through which pass particles of lower energy, so that all the particles are deflected through approximately the same angle. (M.C.G.)

Astrophysics and Cosmology

16629 (AD-430410) AERODYNAMIC ASPECTS OF THE MAGNETOSPHERIC FLOW. Research Report No. 170. R. H. Levy, H. E. Petschek, and G. L. Siscoe (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Dec. 1963. Contract Nonr-2524(00). 24p.

The extent to which solar wind flow can be analyzed by the techniques of continuum fluid mechanics is discussed in relation to the observational and theoretical evidence. Numerous calculations have been made to determine the shape of the magnetosphere cavity, the location of the bow shock, and the variations in flow properties within the shock layer. Observations of auroral motions and alignments have indicated that flow patterns with appreciable velocities also exist inside the magnetosphere, thus suggesting appreciable coupling across the boundary. In general, an appreciable change in magnetic field direction across this boundary is expected. Analysis of such a boundary leads to a rate of reconnection of the field lines which decreases only logarithmically with the magnetic Reynolds number. The logarithmic dependence implies a rapid rate of reconnection which is very insensitive to the uncertainties in the effective conductivity of the plasma. Applying this result to the flow over the magnetosphere, it is concluded that more than 10% of the magnetic field lines brought to the surface of the magnetosphere by the solar wind get broken and reconnected to the earth's polar field lines. This rapid rate of reconnection is in rough quantitative agreement with the suggestion that the internal flow results from the field lines which extend into the interplanetary plasma being dragged by the wind. 48 references. (auth)

16630 THE SPECTRA OF HELIUM STARS. I. WAVELENGTHS AND EQUIVALENT WIDTHS FOR HD 168476 AND HD 124448. P. W. Hill (Radcliffe Observatory, Pretoria). Monthly Notices Roy. Astron. Soc., 127: 113-31 (1964).

Wavelengths and equivalent widths are given for absorption lines in the spectra of the helium stars HD 168476 and HD 124448. The absence of lines of hydrogen and oxygen noted at lower dispersion is confirmed on coudé spectrograms of dispersion 15.6 Å/mm. Apart from these the ions present are those to be expected in normal B-type stars. He I was detected in both stars. Lines of ions of the iron group of elements are numerous and strong in the spectrum of HD 168476, probably because of the reduced opacity due to hydrogen deficiency. The approximate spectral types are B_5 for HD 168476 and B_3 for HD 124448. (auth)

16631 RECOMBINATION SPECTRA. I. CALCULATIONS FOR HYDROGENIC IONS IN THE LIMIT OF LOW DENSITIES. R. M. Pengelly (Queen's Univ., Belfast). Monthly Notices Roy. Astron. Soc., 127: 145-63(1964).

The capture–cascade equations are solved for a hydrogenic system with an infinite number of energy levels. It is assumed that radiative processes alone determine the populations of the states nl. The rate of populating nl due to the processes of capture and cascade is $N_e N_+ \alpha_{nl}^{(c)}$ and the quantum emission rate in a line $n \rightarrow n'$ is $N_e N_+ \alpha_{nn'}$. The coefficient $\alpha_{nl}^{(c)}(T)$ is tabulated for Cases A and B (nebulae optically thin or optically thick in Lyman lines) and for T in the range $T = 10^4 t$°K, $\log_2 t = -3(1)3$. The intensities of the Balmer, $I_{n\rightarrow 2}$, and Paschen $I_{n\rightarrow 3}$ lines in the recombination spectra of H I, and the Pickering, $I_{n\rightarrow 4}$, and Pfund, $I_{n\rightarrow 5}$, lines in the spectra of He II are tabulated relative to $I_{4,2}$ (H I λ 4861) = 100 and to $I_{4,3}$ (He II λ 4686) = 100 respectively. The tables are for $n \leq 20$ and T in the range given above. Values are also given for the absolute intensities of $I_{4,2}$(H I) and $I_{4,3}$(He II). Calculated relative intensities in the spectra of H I and of He II are compared with observed intensities in the planetary nebula NGC 7662. The agreement is not altogether satisfactory. To obtain better agreement it appears to be necessary to take account of collisional transitions $nl \rightarrow nl \pm I$ for the higher levels. (auth)

16632 RECOMBINATION SPECTRA. II. COLLISIONAL TRANSITIONS BETWEEN STATES OF DEGENERATE ENERGY LEVELS. R. M. Pengelly and M. F. Seaton (University Coll., London). Monthly Notices Roy. Astron. Soc., 127: 165-75(1964).

Previous work showed that calculated recombination spectra may be sensitive to collisional transitions of the type $nl \rightarrow nl'$ ($l' = l \pm I$). With equal energies for nl, nl',

the usual collision theory expressions give infinite cross sections, but finite results are obtained on introducing a cut-off at large impact parameters. At very low densities the cut-off is determined by the radiative lifetimes of the excited states and at higher densities it is determined by the Debye radius. For conditions in planetary nebulae ($N_e \sim 10^4$ cm^{-3}, $T_e \sim 10^4$°K), collisional transitions, $nl \rightarrow nl'$, are faster than radiative transitions, $nl \rightarrow n'l'$ ($n' < n$), for $n \gtrsim 15$ for H I and for $n \gtrsim 22$ for He II. (auth)

16633 RECOMBINATION SPECTRA. III. POPULATIONS OF HIGHLY EXCITED STATES. M. F. Seaton (University Coll., London). Monthly Notices Roy. Astron. Soc., 127: 177-84(1964).

Assuming an electron temperature T = 10^4°K and an electron density $N_e = 10^4$ cm^{-3}, which are typical values for planetary nebulae, the level populations of hydrogen are calculated allowing for: radiative capture and cascade; collisional ionization and three-body recombination; collisional $n \rightarrow n \pm 1$ transitions. It is only for large values of n, $n \gtrsim 40$, that the level populations differ significantly from those obtained in the usual radiative theory. Whereas the radiative theory predicts a sharp drop in intensity on the long wavelength side of the Balmer limit, this theory predicts a more gradual decrease, extending over about 5 Å. This effect should be clearly observable on high dispersion spectra. (auth)

16634 A NOTE ON METAL-DEFICIENT RED GIANT STARS. F. E. Clifford and R. F. Tayler (Dept. of Applied Mathematics and Theoretical Physics, Cambridge, Eng.). Monthly Notices Roy. Astron. Soc., 127: 185-90 (1964).

In a recent paper Wallerstein, Greenstein, Parker, Helfer and Aller showed that three red giants, which have overall extreme metal deficiencies, also have detailed abundance anomalies from element to element. Specifically vanadium, manganese, and cobalt are less abundant compared to iron than in the Sun. On the assumption that these e-process metals were formed in a single supernova, it is now shown that the elements were probably processed at high density (~10^8 g/cm^3) and relatively low temperature (~2.6 × 10^9°K). These conditions are essentially those of a low mass type I supernova. This result leads to some difficulties; the very low metal abundances suggest that the stars are extremely old whereas stars that become type I supernovas require a relatively long time to evolve. A possible solution of this difficulty is discussed; the e-process material might be formed in a young massive star and processed from material that had previously undergone the iron–helium and helium–neutron phase changes. (auth)

16635 EXCITATION OF CORONAL LINES BY PROTON IMPACT. M. F. Seaton (University Coll., London). Monthly Notices Roy. Astron. Soc., 127: 191-4(1964).

Cross sections are calculated for the transition Fe^{+13} $3p^1/_2 \rightarrow 3p^3/_2$ produced by proton impact. The excitation rate increases rapidly with increasing temperature. At coronal temperatures the number of $3p^1/_2 \rightarrow 3p^3/_2$ transitions produced by proton impact is comparable with the number directly produced by electron impact but is smaller than the rate of population of $3p^3/_2$ due to electron impact excitation of allowed transitions from $3p^1/_2$, followed by cascade to $3p^3/_2$. (auth)

16636 A SOURCE OF ENERGY FOR RADIO GALAXIES. L. Woltjer (Universite, Leiden). Nature, 201: 803-4(Feb. 22, 1964).

The idea that a very close-packed set of stars might evolve through collisions and provide an energy source for radio galaxies is discussed. The theory consists of concentrating a very large mass into a comparatively small volume, and of then drawing on gravitational energy (through the virial theorem). (P.C.H.)

16637 FLUCTUATIONS IN RADIO ASTRONOMY AND NUCLEAR REACTIONS. N. W. Tanner and D. M. Brink (Oxford Univ.). Nature, 201: 806-7(Feb. 22, 1964).

The relation between fluctuations of intensity and fluctuations of a nuclear reaction cross section are discussed by considering the cross-correlation of intensity fluctuations observed by two receivers (or two counters in the nuclear case). The main features of nuclear reactions are given. (P.C.H.)

16638 OBSERVATION OF A SOLAR TYPE RADIO BURST FROM A FLARE STAR. A. C. B. Lovell (Univ. of Manchester, Eng.), Fred L. Whipple, and Leonard H. Solomon. Nature, 201: 1013-14(Mar. 7, 1964).

During observations of the star UV Ceti in Oct. 1963, radioemission was recorded on two frequencies that appears to have a different relationship with the visible flare. A pronounced time lag between the maximum of the optical flare and the maxima of the radioflares, and the time difference between the radio maxima on the two frequencies was compared with frequency drift type solar radio bursts. A comparison of the major features of the UV Ceti flare with the mean values for the drift type solar bursts is tabulated. Available evidence both in regard to temporal relationships and spectra suggests that the flare on UV Ceti is analogous to the large solar noise storms or Type I bursts, whereas the other represents a much rarer type of event analogous to frequency drift solar bursts. (P.C.H.)

16639 CHRONOLOGY OF THE GALAXY. Donald D. Clayton (Rice Univ., Houston, Tex.). Science, 143: 1281-6(Mar. 20, 1964).

Two well-established observational techniques for determining the age of the galaxy are discussed. The first is the determination of the ages of clusters of stars having a common origin. Special attention is given to the second technique in which use is made of the systematic nuclear properties of radioactive decay and of nucleosynthesis to determine the time of formation of the heavy elements that eventually condensed and formed the solar system and the duration of the process. A recent evaluation of radioactive decays indicates that synthesis of the heavy elements that were to condense into the solar system began about 13 billion years ago. The rate of increase in the concentrations of metals in observed star clusters, on the other hand, indicates that most of the heavy elements began to be synthesized between 20 and 15 billion years ago. It is speculated that extensive star formation began in the galaxy about 15 billion years ago. (P.C.H.)

16640 ROCKET MEASUREMENTS OF THE SUN'S X-RAY 'TAIL' WITH A SIMPLE PHOTOGRAPHIC DETECTOR. K. A. Pounds and P. W. Sanford (Leicester Univ., Eng.). p.50-6 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Results are given of four rocket flights of a simple photographic detector used to monitor the solar x-ray emission below 20 Å. The four flights took place between September 1959 and October 1961, all at times of no flare activity. The best record was obtained from the flight of 27th September 1961, which yielded both intensity and slope of the sun's spectrum in the range from 5 to 15 Å. It is shown that this spectral slope has an equivalent grey-body

temperature of 1.15×10^6 °K at 13 to 15 Å increasing to 2.9×10^6 °K at 5 to 7 Å. This result and the spectral intensities obtained in the other three flights appear to be generally compatible with photon counter measurements. It is suggested that the measurements agree fairly well with a combination of photo recombination and line emission from a 'hot' region in the corona. (auth)

16641 COMPARISON BETWEEN THEORY AND MEASUREMENTS OF THE X-RAY EMISSION OF THE SUN. G. Elwert (Universität, Tubingen, Ger.). p.57-62 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

By pursuing the theory of the x-ray emission of the quiet and disturbed corona and its effect in the atmosphere of the earth, a comparison of theory and measurements is given. The total intensity between 44 and 100 Å is of the same order of magnitude as calculated; its variation with solar cycle corresponds to the variation of the electron density in the corona. A detailed comparison with the theory is possible with the measured spectrum of the x-ray radiation. In this spectrum lines can be detected; their wavelengths and intensity distribution are in good agreement with the calculations. The conception that the radiation below about 20 Å has its origin in disturbed regions of higher density and temperature is confirmed by the measurements of a variable radiation in this wavelength region. The increase of intensity in bright spots visible in an x-ray picture of the sun is in reasonable agreement with the theoretical expectation. Finally the x-ray emission below 0.6 Å during the flare of August 31, 1959, is considered and a relation between the x-ray and the particle emission is stated. (auth)

16642 THE BEHAVIOUR OF THE D LAYER UNDER BOMBARDMENT FROM SOLAR COSMIC RAYS AND THE PARAMETERS DETERMINING THE FREE ELECTRON DENSITY IN THE LOWER IONOSPHERE. W. Webber (Univ. of Minnesota, Minneapolis). p.63-70 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The behavior of the D region under bombardment by solar protons of energy greater than a few Mev is discussed. In particular the variation of the ionospheric parameters that determine the equilibrium electron density is investigated as a function of incident solar particle flux. This is done by measuring the normal diurnal changes in the absorption of galactic radio waves during times when the incident particle flux remains almost constant. As a result of this investigation values are obtained for the coefficients of two important processes determining the free electron density in the lower ionosphere—collisional detachment of electrons from O_2^- and positive-ion-negative-ion recombination. (auth)

16643 SOLAR ECLIPSE AND SOLAR FLARE EFFECTS IN THE F2 REGION. V. C. A. Ferraro (London Univ.), J. E. C. Gliddon, and P. C. Kendall. p.71-5 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The effects of eclipses and solar flares on a quiet F2 region are derived theoretically on the assumption that decreases or increases in electron density are due to temporary decreases or increases in solar radiation. Using generally accepted values of loss and diffusion coefficients, it is found that recovery-times appear to be greater than those observed, although time variations are in qualitative agreement with observations. (auth)

16644 DOPPLER STUDIES OF THE IONOSPHERIC EFFECTS OF SOLAR FLARES. K. Davies (National Bureau of Standards, Boulder, Colo.). p.76-83 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Data and theory are presented showing some effects of solar flares on the ionosphere. The method of observation involves the spectrum analysis of reflected radio waves in the high frequency band. By measurements of the simultaneous changes in phase path and absorption of the signals from WWV it is possible to estimate the height at which the flare-produced electrons are created. The technique is shown to be relatively sensitive for the detection of flare effects. Four individual flare events are used to show the great variability of flares. Some flares are accompanied by high absorption and large change of phase path, others by no measurable effects, and other effects lie in between. (auth)

16645 SOME EARLY RESULTS FROM THE X-RAY SPECTROMETER IN SATELLITE UK1. K. A. Pounds (Leicester Univ., Eng.) and A. P. Willmore. p.513-16 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

A preliminary analysis is carried out on data obtained from the proportional counter spectrometer in satellite UK1 during its first week in orbit. X-ray spectra in the wavelength band 4 to 14 Å are given for both the quiet and flare active sun. A slow variation in the mean radiation level from the quiet sun is observed over a period of several days. The variation follows a similar change in intensity of the integrated coronal green line. Considerable intensification and hardening of the solar emission is found coincident with a number of solar flares. (auth)

16646 THE POSSIBLE ROLE OF FIELD-ALIGNED DUCTS IN THE ESCAPE OF DECAMETER RADIATION FROM JUPITER. Thomas D. Carr (Univ. of Florida, Gainesville). 13p. (CONF-413-1)

From Proceedings of the Discussion Meeting Relative to the Planet Jupiter, New York, Oct. 1962.

A duct model for the production and escape of Jovian decameter radiation is used to describe the sporadic pulses from noise storms. Observed polarization effects are also discussed using the model. (R.E.U.)

Atomic Physics

16647 (KAPL-M-CHR-7) STOCHASTIC MODELS FOR HETEROGENEOUS MATERIALS, II. (BASIC THEORY AND FINE STRUCTURE). Charles H. Randall (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 1963. Contract W-31-109-eng-52. 212p.

The basic ideas associated with treating a heterogeneous material as a stochastic process are presented. The spectral analysis approach is introduced and developed. The analysis is formalized to some degree, and a more detailed consideration of elementary concepts is included. A detailed description of fine structure as well as large scale inhomogeneity is given. Related stochastic processes are briefly considered. Particular models and supplementary topics are relegated to appendices. (L.B.S.)

16648 (NP-13739) CONTINUUM RADIATION BEHIND A BLAST WAVE. Report No. 5. Robert A. Gross (Co-

lumbia Univ., New York. School of Engineering and Applied Science). Aug. 1963. 54p.

The principal results of idealized blast wave theory are presented and extended to include the effects of ionization and radiation. The conditions required to maintain blast wave dynamic similarity with radiation are set forth. Electron density and continuum radiation are determined as a function of position behind a blast wave for the plain, cylindrical and spherical cases. (auth)

16649 (ORNL-3485) THE ANGULAR AND SPECTRAL DISTRIBUTIONS OF LIGHT EMITTED FROM ELECTRON-BOMBARDED SILVER FOILS. Norma O. Davis, E. T. Arakawa, L. C. Emerson, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Mar. 1964. Contract W-7405-eng-26. 72p.

The spectral distribution of photons emitted by Ag foils 660 and 1980 Å in thickness bombarded by 40-kev electrons was determined experimentally in the wavelength region from 2500 to 5600 Å. The spectra were determined for photons emitted at 0 to 150° from the foil normal using an angular distribution chamber that permitted the spectrometer to be rotated around the foil in a continuous fashion without breaking the vacuum. A Glan prism analyzer was used to separate the light into a component polarized parallel to the plane of the electron and photon and another component perpendicular to it. Transition radiation is polarized in the parallel plane, while bremsstrahlung has both a parallel and perpendicular component. The photon in the perpendicular plane was found to be about 10% of that in the parallel plane. The spectrum in the parallel plane showed a sharp peak at 3300 Å, this value being an average over photon directions from 10 to 50° from the foil normal. This agrees with the theoretical predictions and is within the limits of error of previous determinations at 30°. In addition to the peak, the spectrum showed a continuum which decreased slowly with increasing wavelength, and was characterized by a deep minimum at 3200 Å and a rise in the short wavelength region. All features of the observed spectrum are accurately predicted by Ritchie's generalized transition radiation theory. The angular distribution of photons emitted at the wavelength of the peak showed a maximum intensity at 30° from the foil normal with zero intensity at 0° and near 90°, while the proton intensity at other wavelengths in the continuum (2700 and 4500 Å) was a maximum at 50° from the foil normal. The long wavelength continuum for the Ag foil 660 Å thick was more intense in the forward than in the backward direction, in agreement with theory. The photon yield was found to agree with the theoretical prediction in all respects at all wavelengths except at that of the sharp peak for photon directions from 10 to 40° where the experimental values were about 30% lower. On the basis of the agreement between the absolute measurements of the photon intensity and theoretically predicted intensities it is concluded that the light observed is due almost entirely to transition radiation. (auth)

16650 (TID-7689(p.80-1)) A REPORT ON COMPILATION OF SOME BETA-EXCITED SPECTRA. L. E. Preuss, H. Collins, and E. R. Wilson (Henry Ford Hospital, Edsel B. Ford Inst. for Medical Research, Detroit).

Data on spectra excited by impingement of beta particles is being collected and cataloged on a comparative basis. Methods used in selecting this data and compiling it are described. (M.C.G.)

16651 (UCRL-10925) PROGRAMS FOR CALCULATING RELATIVE INTENSITIES IN THE VIBRATIONAL STRUCTURE OF ELECTRONIC BAND SYSTEMS. Richard N. Zare (California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 19, 1963. Contract W-7405-eng-48. 59p.

Source-deck listings of two computer programs are given for the calculation of relative intensities in the vibrational structure of an electronic transition. The first program finds turning points of an electronic potential-energy curve by direct numerical evaluation of the Klein action integrals in the RKR procedure. The second program uses these turning points to construct an effective potential for the molecule with rotational quantum number J. The radial Schrödinger equation then is solved for this potential to yield vibrational-rotational wavefunctions from which the program calculates Franck-Condon factors, r-centroids, and relative intensities. Sample input and output are included. (auth)

16652 (UCRL-Trans-1026(L)) APPROXIMATION METHOD FOR CALCULATING THE DENSITY MATRIX BASED ON PATH INTEGRALS. Ryuzo Abe. Translated by R. Kikuchi and R. Abe (Univ. of California, Lawrence Radiation Lab., Livermore), from Busseiron Kenkyu, No. 79, 101-28(1954). 51p. (Includes original, 29p.)

The density matrix for a system with a hamiltonian at an inverse temperature $\beta = 1/kT$, defined as $\rho(q',q_0;\beta) = \langle q'|e^{-\beta H}|q_0\rangle$, can be rewritten as a path integral similar to the one introduced by Feynman. The path integral can be evaluated approximately be determining the path that gives the largest contribution to the integral, then making a Taylor expansion of the other paths around this one. The technique is applied to the linear harmonic oscillator, and then to the electron-phonon system. For the case in which a magnetic field is applied to the system, an expression is found for the density matrix, identical to that obtained previously by Sondheimer. (auth)

16653 (UCRL-Trans-1032) ANALYSIS OF VELOCITY DISTRIBUTION IN A MOLECULAR BEAM BY MEASUREMENT OF TIME OF FLIGHT. Friedrich Knauer. Translated by Margaret Little (Univ. of California Lawrence Radiation Lab., Berkeley), from Z. Physik, 126: 319-35(1949). 36p. (Includes original, 17p.)

A molecular beam of potassium is interrupted periodically, and, after a travel of about 10 cm, it is detected by measurement of the ion current on a hot tungsten wire. The ion current does not arise suddenly each time when the beam is released, but gradually, in correspondence with the dominant velocity distribution of the beam, and with a certain time lag. The time derivative of the curve of the ion current represents the velocity distribution of the atoms in the beam. Differentiation is carried out electrically, and the velocity distribution is displayed visually on a synchronizing cathode-ray oscilloscope, and is recorded photographically. With high beam concentrations, the well-known deviation from the Maxwell distribution is observed. (auth)

16654 EQUATION OF STATE FOR PARAHYDROGEN. E. A. Tkachenko, E. M. Holleran, and R. A. Moses (St. John's Univ., New York). Cryogenics, 4: 12-16(Feb. 1964).

A pressure-explicit equation of state is presented for parahydrogen describing the experimental data of Goodwin, Diller, Roder, and Weber, which consist of over 1,200 points ranging between 2 and 365 atm, 19 and 100°K, and 0.0011 and 0.044 moles/cm^3. The equation is a modification of that of Hirschfelder, Buehler, McGee, and Sutton and is divided into different expressions for the three regions representing low density gas, high density gas, and liquid. The equations for the three regions are continuous at their boundaries through the second partial derivatives

of pressure with respect to density and temperature. Besides relatively high accuracy, the proposed equation of state possesses reasonable extrapolation properties, and is of a form that allows analytical integration of the theoretical expressions for thermodynamic properties such as enthalpy, entropy, and internal energy. (auth)

16655 EXPONENTIAL CORRELATION FUNCTIONS FOR TWO-ELECTRON ATOMS. H. O. Pritchard (Univ. of Manchester, Eng.). J. Chem. Phys., 40: 1496-1505 (Mar. 15, 1964).

Inclusion of an exponential term in r_{12} in the correlated orbital treatment of two-electron atoms does not lead to a significant improvement in the calculated energy. However, it does cause the orbital cusp conditions to be satisfied more accurately, and at the same time, it leads to a very considerable reduction in the computing time required. (auth)

16656 ANALYTICAL EXPRESSIONS FOR THE HARTREE-FOCK POTENTIAL OF NEUTRAL ATOMS AND FOR THE CORRESPONDING SCATTERING FACTORS FOR X RAYS AND ELECTRONS. T. G. Strand and R. A. Bonham (Indiana Univ., Bloomington). J. Chem. Phys. 40: 1686-92 (Mar. 15, 1964).

Approximate analytical expressions for the Hartree-Fock potential of neutral atoms to Z = 36 were obtained by fitting the radial electron density with an analytical expression by least squares. The expression for the radial density corresponds to the following form of the screening factor: $Z_p(r)/Z = \sum_{j=1}^{2} {}^{a}\gamma_j \exp(-{}^{a}\lambda_j r) + r \sum_{j=1}^{m} {}^{b}\gamma_j \exp(-{}^{b}\lambda_j r)$, where m = 2 for Z = 2 to Z = 18 and m = 3 for Z = 19 to Z = 36. The corresponding expressions for the mean radius, the mean square radius, the diamagnetic susceptibility, and the atomic scattering factors for x rays, and for electrons according to the first Born approximation are given. The accuracy of the approximate expressions is discussed in relation to results obtained by numerical calculations from the Hartree-Fock wavefunctions for the atoms. (auth)

16657 DELTA-FUNCTION MODEL FOR INTERACTION OF TWO-ELECTRON ATOMS AND IONS. Gunter G. Weber (Yale Univ., New Haven). J. Chem. Phys., 40: 1762-8 (Mar. 15, 1964).

The interaction energy of two-electron atoms and ions in the repulsive range can be calculated by applying a δ-function potential. The δ-function formalism is described and justified. It is applied to HeHe, Li^+Li^+, H^-H^-, Li^+He, Li^+H^-, HeH^-. Analogies with well-known methods are shown and the results are compared with those of other theories. (auth)

16658 ATOMIC ENERGY LEVELS AND EIGENFUNCTIONS FOR THE ATOMIC FIELD. T. Tietz and J. Florczak (Univ. of Lodz, Poland). Nuovo Cimento (10), 31: 691-3(Feb. 1, 1964).

A method for determining the eigenvalues and eigenfunctions for a given atomic field is presented. The particular case of Z = 74 is treated. (C.E.S.)

16659 DETERMINATION OF THE CONCENTRATION OF CHARGED PARTICLES IN A LOW-PRESSURE DISCHARGE FROM H_β LINE BROADENING. L. A. Luizova. Opt. Spectry. (USSR) (English Transl.), 15: 455-6(Dec. 1963).

Measurements were made of the charged-particle concentration in a d-c neon discharge at pressures of 5 to 40 mm Hg and currents of 0.2 to 1 amp, from the H_β line broadening, and the results were compared with two-probe measurements. Knowing the gas temperature and the measured width of the H_β line, the ion concentration can be obtained from the curves plotted. The results showed that the ion concentrations are in good agreement for all values. (P.C.H.)

16660 NON-LINEAR RESISTANCE OF THERMAL AND NON-THERMAL ORIGIN IN BISMUTH AND REHEATED PYROLYTIC GRAPHITE. H. J. Goldsmid and J. M. Corsan (General Electric Co., Ltd., Wembley, Eng.). Phys. Letters, 8: 221-2(Feb. 15, 1964).

The resistance of bismuth and reheated pyrolytic graphite at liquid helium temperature in a magnetic field of 27 kOe and 43 kOe, respectively, was measured using current pulses of variable duration and repetition rate. Nonlinearity in the current-voltage plots was observed at pulse repetition rates of 281 to 6000 cps with 20 μs pulses for bismuth, and pulse repetition rate of 108 cps with 5 μs pulses for pyrolytic graphite. (L.B.S.)

16661 CALCULATION OF ABSOLUTE IONIZATION CROSS SECTIONS OF He, He*, He^+, Ne, Ne*, Ne^+, Ar, Ar*, Hg, AND Hg*. L. Vriens (Universiteit, Utrecht). Phys. Letters, 8: 260-1(Feb. 15, 1964).

The theory of Gryzinski, the experimentally known ionization energy, and the number of electrons in the shell were used to calculate the absolute ionization cross sections of helium, helium ions, neon, neon ions, argon, mercury, and metastable states of these elements. Curves are presented for calculated and measured ionization functions. (L.B.S.)

16662 CORRELATION BETWEEN THE KINETIC AND POTENTIAL ENERGY OF AN IONIZED GAS. O. Theimer and W. Deering (New Mexico State Univ., University Park). Phys. Rev., 134: A287-95(Apr. 20, 1964).

The thermodynamic functions of a system of free electrons and ions are calculated by the methods of classical statistical mechanics under the condition that bound-particle states with negative internal energy, e.g., atoms, are explicitly excluded from the partition function. This exclusion is found to have the following consequences: (1) The radial distribution function of electrons about ions has the form $g^{+-}(r) = 2\pi(\pi kT)^{-\frac{1}{2}} \times \int_0^\infty \exp(-\epsilon/kT)[\epsilon + w(r)]^{\frac{1}{2}} d\epsilon$, where ε is the internal energy of an ion-electron pair and w(r) is a potential of average force. (2) w(r) is obtained as an iterative solution of the nonlinearized Poisson equation and used for calculating the system's potential energy U. No divergence arises and U is found different from the Debye-Hückel energy U_D by amounts between 5 and 10% of U_D. (3) The average kinetic energy at position r is found to depend on w(r). The total kinetic system energy per particle is found to differ from 3kT/2 by about 50% of U_D. (auth)

16663 CHARACTERISTIC X-RAY PRODUCTION IN THE L_{III} SHELL OF COPPER BY LOW-ENERGY (100- TO 500-kev) PROTONS. J. M. Khan, D. L. Potter, and R. D. Worley (Univ. of California, Livermore). Phys. Rev., 134: A316-20(Apr. 20, 1964). (UCRL-7541)

Characteristic L-shell x rays produced when protons of 100- to 500-kev energy are stopped in thick targets of copper have been studied using proportional counter detection. As a consequence of self-absorption in the L_{II} and L_{III} shells, the relative intensities of the various L lines change with depth of penetration (hence energy) of protons. By use of additional copper absorbers, lines originating from the filling of vacancies in the L_{III} shell can be isolated. [A single-crystal (KAP) spectrometer was used to verify this for electron-excited spectra.] The thick-target yields for the L_{III} lines and the highly

self-absorbed lines as well as the x-ray production cross section for the L_{III} lines are presented. With a fluorescent yield of 0.05, the ionization cross section ($\sigma_I = 3.6 \times 10^{-22}$ cm) at 100 kev is approximately two orders of magnitude lower than the value predicted on the basis of the Born approximation description of the proton trajectory. (auth)

16664 THEORY OF SPIN-ORBIT COUPLING IN ATOMS. PART III. M. Blume (Brookhaven National Lab., Upton, N. Y.), A. J. Freeman, and R. E. Watson. Phys. Rev., 134: A320-7(Apr. 20, 1964). (BNL-7609)

Spin-orbit coupling constants were calculated for a number of 4d and 4f shell ions, as well as for some excited states of Li and Cu. The calculations are based on a theory in which the contribution of two-body spin-orbit interactions to the coupling constant is taken into account and exchange effects are included. Fair agreement with experiment is obtained, and several possible reasons for the discrepancies which do occur are discussed. The relation of spin-orbit coupling to hyperfine structure is also considered. (auth)

16665 POSITRON ANNIHILATION IN ALKALI HALIDES. A. Bisi, A. Fiorentini, and L. Zappa (Instituto di Fisica del Politecnico, Milan). Phys. Rev., 134: A328-31(Apr. 20, 1964).

The time annihilation spectrum of positrons in most alkali halides is measured. Positrons appear to decay through at least two different processes which lead to a complex time annihilation spectrum. The first component is conceivably due to positrons which annihilate when free; the second, which occurs with an intensity I_2 between 25 and 85%, is characterized by a mean life τ_2 whose amount ranges between 4×10^{-10} and 8×10^{-10} sec. From the whole set of the collected data, empirical regularities can be extracted; the annihilation rate λ_2 appears simply correlated with the molecular density n within each halides series, according to the relation: $\lambda_2 = \lambda_0 + \alpha n$. λ_0 decreases, passing from fluorides to bromides, and α turns out to be simply proportional to the square of the radius of negative ion. The τ_2 component is sensitive to the application of a static magnetic field; the magnetic quenching, however, is appreciably lower than what would be expected if one attributes this component to the decay of a free positronium atom. (auth)

16666 ABSOLUTE IONIZATION CROSS SECTIONS OF THE ALKALI METALS. G. O. Brink (Univ. of California, Livermore). Phys. Rev., 134: A345-6(Apr. 20, 1964). (UCRL-7492)

The absolute values of the cross sections for ionization by electron impact of sodium, potassium, rubidium, and cesium have been measured by a modulated crossed beam technique. The values obtained for the maximum cross sections are tabulated and were observed to increase with increasing atomic number. An unsuccessful attempt was made to measure the ionization cross section of lithium. (auth)

16667 LARGE-ANGLE, SINGLE-COLLISION SCATTERING OF ARGON IONS (40-80 kev) FROM METALS. Sheldon Datz and Cornelis Snoek (FOM-Laboratory for Mass Separation, Amsterdam). Phys. Rev., 134: A347-55(Apr. 20, 1964).

The energy and angular distribution of the "secondary ions" obtained from the bombardment of metallic surfaces (Cu, Ag, Au) by Ar^+ ions (40–80 kev) shows that most of these ions arise from biparticle collisions between the incoming argon ion and a surface atom which is effectively isolated from lattice interactions. Effects attributable to multiple collisions were minimized, in the case of Cu, by the use of oriented single-crystal targets. Multiply charged species of both the projectile atoms (Ar^+ to Ar^{6+}) and the target atoms (1+ to 5+) were detected. Their angular distributions were qualitatively similar to those obtained in previous gas scattering experiments. (auth)

16668 MOBILITY OF ELECTRONS IN THE NOBLE GASES. Joseph C. Bowe (Argonne National Lab., Ill.). Phys. Rev., 134: A355-61(Apr. 20, 1964).

A theoretical study which leads to formulas that relate the cross section for inelastic collisions near the threshold energy to the drift velocity v_d of electrons in noble gases is made. Derivation of general formulas for v_d follows a qualitative interpretation of the main features of the experimental drift-velocity curves. The formulas for v_d are derived for the case in which the elastic cross section for momentum transfer is given by $N_0 Q_m(v) = av^{j-1}$. Closed-form expressions for v_d are obtained by integrating only over the distribution function for electrons that have energy less than the excitation energy u_1. By this procedure, integration over the high-energy ($u > u_1$) distribution function is avoided and the use of analytical methods is made possible. A partial correction to this approximation is obtained by extending the low-energy ($u < u_1$) distribution function to pass through zero at an energy u_0 that is greater than u_1. From the drift-velocity formula and the experimental values of v_d, the cutoff energy u_0 can, in principle, be evaluated as a function of E/p. The high-energy distribution function is used to derive an expression for the overshoot ($u_0 - u_1$) which is shown to be proportional to $(E/p)^{2/(\gamma+2)}$ and to depend upon the constants h and γ when the inelastic-collision cross section has the form $Q_1(u) = h(u-u_1)^\gamma$. Possible applications of these theoretical results to drift-velocity data for gas mixtures are also briefly discussed. (auth)

16669 ASYMPTOTIC EXCHANGE COUPLING OF TWO HYDROGEN ATOMS. Conyers Herring and Michael Flicker (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 134: A362-6(Apr. 20, 1964).

The energy difference 2J between the lowest singlet and triplet states of the hydrogen molecule measures the exchange coupling of the spins of the two atoms. It is known that the Heitler-London expression for 2J is inaccurate, even at large interatomic distances R, because it takes inadequate account of the mutual avoidance of the exchanging electrons. Gor'kov and Pitaevski have recently shown that the leading term in the expression for 2J at large R can be evaluated exactly. The procedure involves treating the interaction of the two atoms as a perturbation on a product of single-atom wave functions. However, their final result differs by a numerical factor, and in the remainder term, from that of an independent though basically identical calculation of ours. It is shown here that the correct result is: $2J = -1.641\, R^{5/2} e^{-2R} + O(R^2 e^{-2R})$, where J is in atomic units (2Ry) and R is in Bohr units. (auth)

16670 DETECTION OF PLASMA RADIATION FROM ELECTRON-BOMBARDED Al AND Mg FOILS. E. T. Arakawa, R. J. Herickhoff, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters, 12: 319-20 (Mar. 23, 1964).

The photon emission spectra from electron-bombarded Al and Mg foils were obtained using a sodium salicylate coated quartz window detector and an ultraviolet spectrometer. A sharp peak at 815 Å was found in the Al spectrum, a broad peak at 1400 Å and a sharp peak at 1800 Å were observed in the Mg spectrum. Both spectra are in good

agreement with electron energy loss experiments and theoretical predictions. (L.B.S.)

16671 A QUANTUM MECHANICAL STUDY OF THE LiH MOLECULE IN THE GROUND STATE. F. E. Harris and H. S. Taylor (Univ. of California, Berkeley). Physica, 30: 105-12(Jan. 1964).

The lithium atom and the lithium hydride molecule are studied by a method in which a product of one electron functions, each of which is a highly variable molecular orbital, is chosen to represent a configuration. All parameters in the wave function are varied in an unrestricted manner so as to minimize the energy. Open shell techniques and configuration interaction are employed. In four configurations 89% of the dissociation energy of LiH is calculated. The energy and the electron distribution are discussed as a function of internuclear distance. (auth)

16672 TEMPERATURE DEPENDENCE OF THE RANGE OF FOCUSED COLLISION SEQUENCES IN COPPER SINGLE CRYSTALS. J. B. Sanders and J. M. Fluit (F.O.M.-Laboratoriuum voor Massascheiding, Amsterdam). Physica, 30: 129-43(Jan. 1964).

The well-known focusing model, which is responsible for the [110] spots, observed in the sputtering of a f-c-c monocrystal describes a series of collisions along a closed packed atom row in f-c-c metals. The range of such a focusing sequence was calculated by Leibfried for copper, using a Born-Mayer potential. For the colliding atoms a hard-sphere model is used. This range is determined from the energy lost at every collision in the sequence by potential interaction with the neighboring [110] rows. Leibfried's treatment was generalized by considering the influence of the thermal vibrations of the crystal atoms on the energy loss per collision above the Debye temperature. The approximation that the thermal vibrations are harmonic was made, and the coupling between nearest and next-nearest neighbors only was taken into account. The coupling constants derived by Jacobsen were used. The mean square of the difference of displacements of two nearest neighbors is computed as a function of temperature. The relative energy loss factor can be calculated as an average over these displacement differences. The result is $\epsilon(T) = \epsilon(0), \exp(23.10^{-4}T)$, where $\epsilon(0)$ is the relative energy loss factor as calculated by Leibfried for a non-vibrating lattice. In the case of gold Nelson, Thompson and Montgomery calculated the relative energy loss per collision due to a different mechanism, namely the scattering of momentum out of the sequence, because of the fact that the thermal vibrations cause the centers of the colliding atoms to be not exactly in one line. Their calculation for copper was repeated and compared with the one obtained for the potential interaction with the neighboring [110] rows. By treating the two effects as additive the range of focusing sequences was obtained as a function of temperature and initial energy. It turns out that these ranges are much smaller than was previously expected. A maximum range of 12 at 315°K and of 4 at 900°K was found. On the basis of these results a qualitative explanation of some features of the sputtering of single crystals is given. Because of the shortness of the average focusing range for sputtering which is 5 at 315°K and 2 at 900°K there will be a significant competition between focusing and defocusing mechanisms in ejecting the sputtered particles. From this it is concluded that the amount of material, deposited in the [110] focused spots will have a weaker dependence on the range of the focusing sequences than a direct proportionality. The total sputtering ratio is expected to vary only slightly with temperature above the Debye temperature. (auth)

16673 SPUTTERING OF COPPER BY 20 kev NOBLE GAS IONS AT LOW TEMPERATURES. J. M. Fluit, C. Snoek, and J. Kistemaker (F.O.M.-Laboratorium voor Massascheiding, Amsterdam). Physica, 30: 144-56(Jan. 1964).

Single crystals of copper and polycrystalline copper were bombarded at normal incidence with 20-kev Ar^+ and Ne^+ ions at various temperatures between 30 and 320°K. The sputtering ratio, S, for Ar^+ on polycrystalline targets as well as on monocrystalline surfaces showed no temperature dependence within the accuracy of measurements between 80 and 350°K. This is attributed to the surface contamination caused by Ar itself, especially at lower temperatures. Bombardment with Ne^+ in the temperature range between 30 and 350°K on polycrystalline Cu and on (111) and (100) single crystal surfaces showed a very pronounced temperature dependence below 200°K. Apparently Ne diffuses through Cu lattices so easily that no serious surface contamination or lattice distortion arises. An explanation is given on the basis of internal focusing mechanisms inside the crystal. A steep decrease in S observed below 150°K is related to the diffusion of the so-called B interstitials in the Cu lattice. On this assumption, the measurements yield an activation energy of (0.29 ± 0.02) ev for the diffusion process. A second steep decrease of the sputtering coefficient below 50°K can be due to the decreased diffusion of A interstitial copper atoms (activation energy 0.1 ev). A sharp rise in S going from about 100 to 50°K probably corresponds to an increasing saturation of the copper lattice with Ne. This was verified by measurement of the gas content present in the targets following bombardment. (auth)

16674 BINDING ENERGY OF H^-. J. D. Weisner and B. H. Armstrong (Lockheed Missiles and Space Co., Palo Alto, Calif.). Proc. Phys. Soc. (London), 83: 31-3(Jan. 1964).

An approximate analytic formula for the H^- photodetachment cross section recently obtained by Armstrong is used to obtain a value of the binding energy E_b of H^- from the Smith and Burch photodetachment data. The result of $E_b = 0.77 \pm 0.02$ ev is in agreement with recent variational determinations. Although this method does not yield an experimental value in the conventional sense, the accuracy of the result is higher than the accuracy of present direct determinations. (auth)

16675 ASYMPTOTIC FORM OF THE ELECTRON CAPTURE CROSS SECTION IN THE IMPULSE APPROXIMATION. R. A. Mapleton (Air Force Cambridge Research Labs., Bedford, Mass.). Proc. Phys. Soc. (London), 83: 35-41(Jan. 1964).

It is shown that the high energy limit of the impulse approximation developed by Pradhan is not uniquely defined for the process $H^+ + H(1s) \rightarrow H(1s) + H^+$. It is argued that the correct limit is identical with that of the first Born approximation. That this result differs from the high energy limit obtained by Bransden and Cheshire in 1963 is a consequence of a discontinuity in the matrix element at this limit. It is also shown how the impulse approximation can be deduced from the sum of the first and second Born matrix elements. This particular form of the second Born matrix element is compared with another form, and the differences are discussed. (auth)

16676 CLASSICAL THEORY OF ION-MOLECULE REARRANGEMENT COLLISIONS AT HIGH IMPACT

ENERGIES. D. R. Bates, C. J. Cook, and F. J. Smith (Queen's Univ., Belfast). Proc. Phys. Soc. (London), 83: 49-57(Jan. 1964).

An impulse-type approximation is used to obtain an expression for the cross section Q for the capture of a light ion or atom from a target system by a fast projectile system. If the impact velocity v is sufficiently high, Q falls off as v^{-11}. Capture in encounters between Ar and H_2^+ or D_2^+, between Ar^+ and H_2 or D_2 and between CH_4 and CH_4^+ are investigated. (auth)

16677 THE CONTRIBUTION OF POSITIVE IONS AND NON-RESONANCE RADIATION TO SECONDARY IONIZATION PROCESSES IN HELIUM. D. K. Davies, F. Llewellyn Jones, and C. G. Morgan (University Coll. of Swansea, Wales). Proc. Phys. Soc. (London), 83: 137-44(Jan. 1964).

A quantitative analysis of ionization growth times measured in pure helium between plane parallel silver electrodes for $5.07 \leq p_0 \leq 38.51$ mmHg, in the range $8.61 \leq E_s/p_0 \leq 38.08$ v cm^{-1} $mmHg^{-1}$, for overvoltages up to 6% was made. This shows that the dominant secondary ionization process at the higher pressures is delayed photoelectric emission due to the incidence at the cathode of collision-induced non-resonance radiation produced in the volume destruction of atoms in the $2\ ^1S$ metastable state in two-body collisions in the gas. The cross section computed for this process is about 3×10^{-20} cm^2/atom. At the lower pressures used secondary electron emission due to the incidence of helium positive ions plays an increasingly important role, contributing as much as 75% of the secondary emission at p = 5.07 mmHg. (auth)

16678 SPIN-CHANGE CROSS SECTIONS BETWEEN HYDROGEN ATOMS. A. Dalgarno (Geophysics Corp., Bedford, Mass.) and R. J. W. Henry. Proc. Phys. Soc. (London), 83: 157-8(Jan. 1964).

The quantal formula for spin change in the collision of a pair of hydrogen atoms is evaluated at temperatures up to 1000°K. Good agreement is obtained at temperatures greater than 10°K with the semi-classical calculations of Smith. (auth)

16679 MOLECULAR COLLISION CROSS SECTIONS AND VIBRATIONAL RELAXATION IN CARBON MONOXIDE. R. Marriott (General Dynamics/Astronautics, San Diego, Calif.). Proc. Phys. Soc. (London), 83: 159-69(Jan. 1964).

A method for the calculation of cross sections for processes involving the exchange of vibrational and translational energy on collision of molecules with internally structureless particles is described. On the assumption that the excited molecule is a simple harmonic vibrator and that the molecular interaction potential may be represented by a spherically symmetric Lennard-Jones function, the partial wave scattering equations were obtained in a form suitable for direct numerical integration. Coupling between any selected number of energetically accessible molecular vibrational states can be retained in this calculation. The collision cross sections are then derived in terms of the asymptotic phases and the amplitudes of the numerical solutions. This treatment of molecular collisions was applied to a study of vibrational relaxation in carbon monoxide. Cross sections were calculated using the Lennard-Jones interaction constants tabulated by Hirschfelder et al. These cross sections are employed for the determination of the vibrational relaxation time in carbon monoxide as a function of temperature. The results are less by a factor of 2.5 than the experimental values over a temperature range of 1000–4500°K. (auth)

16680 GLOCKLER'S EQUATION FOR IONIZATION POTENTIALS AND ELECTRON AFFINITIES. [PART] II. R. J. S. Crossley (Queen's Univ., Belfast). Proc. Phys. Soc. (London), 83: 375-89(Mar. 1964).

The theoretical study of an equation proposed by Glockler for the variation of ionization potentials with atomic number Z and of its applications is extended to cases where degenerate perturbation theory is required. For the equation in the form $I = \alpha Z^2 + \beta Z + \gamma$ the constants α, β, and γ are given in a table for each isoelectronic series up to that of argon. The method is applied to obtain the ionization potential of Ne^{6+} in the beryllium series, to revise ionization potentials in the magnesium series, and to extrapolate ionization potentials in the phosphorus series. Electron affinities of the atoms hydrogen to chlorine are calculated by a modified method and the results are presented in a table. (auth)

16681 THE EXCITATION OF He^+ BY ELECTRONS. P. G. Burke (Atomic Energy Research Establishment, Harwell, Berks, Eng.), D. D. McVicar, and K. Smith. Proc. Phys. Soc. (London), 83: 397-407(Mar. 1964).

The excitation cross sections for the 1s–2s and 1s–2p transitions in He^+ induced by impacting electrons with incident energies between 44.2 and 217.6 ev are evaluated. The basic method used is the close-coupling approximation where the 1s, 2s, and 2p states of He^+ are retained in an appropriately symmetrized expansion of the total wave function. Preliminary investigations of the convergence of the eigenfunction expansion indicate that the results are much more accurate than those in hydrogen. The accuracy of previous calculations is also investigated. (auth)

16682 ELECTRON SCATTERING BY THE HELIUM POSITIVE ION IN THE 1s, 2s, OR 2p STATE. R. McCarroll (Queen's Univ., Belfast). Proc. Phys. Soc. (London), 83: 409-17(Mar. 1964).

The electron-scattering cross sections of He^+ in the 1s, 2s, or 2p state were computed on the basis of the 1s–2s–2p close-coupled approximation, in which full account is taken of electron exchange. Results were obtained at low energies of impact above the threshold of (2s, 2p) excitation for those states of the system with low angular momentum. (auth)

16683 DETACHMENT FROM THE NEGATIVE HYDROGEN ION BY ELECTRON OR POSITRON IMPACT. M. R. H. Rudge (Joint Inst. for Lab. Astrophysics, Boulder, Colo.). Proc. Phys. Soc. (London), 83: 419-24 (Mar. 1964).

The processes $e^+ + H^- \rightarrow H + e + e^+$ are examined allowing for Coulomb distortion in the final state. The cross section for electron impact is found to be very different from that obtained previously. The cross section for positron impact is found to be very large. (auth)

16684 LOW ENERGY COLLISIONS BETWEEN HYDROGEN ATOMS AND PROTONS. D. R. Bates and D. A. Williams (Queen's Univ., Belfast). Proc. Phys. Soc. (London), 83: 425-33(Mar. 1964).

Slow encounters between H(1s) atoms and H^+ ions are investigated theoretically, taking into account the coupling between the $2p\sigma$ and $2p\pi$ states of the quasi H_2^+ molecule. It is found that this coupling makes the cross section for excitation of the second quantum level remarkably large. Calculations are also carried out on the probability P_c of electron capture at a fixed (3°) scattering angle and at impact energies E between about 0.25 and 4 kev. The turning points E_T on the computed (P_c, E) curve lie close to those on the corresponding measured curve of Lockwood and Everhart; and $P_c(E_T)$ is not exactly unity or exactly zero as in earlier theoretical work but is instead less than unity or greater than zero in qualitative accord with

experiment; quantitative accord would seemingly require allowance for $2p\sigma-3p\sigma$ and perhaps other couplings. (auth)

16685 THE ANGULAR DISTRIBUTION OF CHARACTERISTIC X RADIATION AND ITS ORIGIN WITHIN A SOLID TARGET. M. Green (Cambridge Univ., Eng.). Proc. Phys. Soc. (London), 83: 435-51(Mar. 1964).

Angular distributions of characteristic x-ray intensity were measured for targets of widely different atomic number with incident electron energies from 0 to 50 kev. For the light elements, where characteristic radiation is produced mainly by direct electron impact, the experimental results are well represented by a universal set of curves. A point source model of x-ray production explains the main features of these curves. In heavy elements, fluorescence generated by the continuous x-ray spectrum is important. Theoretical distributions of continuous fluorescence were derived by numerical integration, and agree with the corresponding observed distributions within the limits of experimental error. (auth)

16686 HYDROGEN ENERGY LEVELS: PERTURBATION CAUSED BY PROTON STRUCTURE. William S. Porter (Bucknell Univ., Lewisburg, Penna.). Science, 143: 1324-5(Mar. 20, 1964).

Shifts in the lowest electronic energy levels of the hydrogen atom caused by the extended charge distribution of the proton were calculated and found to be of the order of the unexplained portion of the Lamb shift for these levels. (auth)

16687 ON THE TEMPERATURE DEPENDENCE OF THE INTENSITY OF ROENTGEN INTERFERENCES OF TUNGSTEN OVER A TEMPERATURE RANGE OF 300-1100°K. E. I. Geshko, G. P. Kushta, and V. P. Mikhalchenko (Chermovtsky State Univ., USSR). Ukr. Fiz. Zh., 8: 1358-63(1963). (In Ukrainian)

By means of a specially assembled x-ray diffractometer (based on the YPC-70 set-up and the ГУР-2 goniometer), supplied with a high-temperature vacuum chamber, the temperature dependence of the intensity of x-ray interference maxima of tungsten over a temperature range of 300-1100°K was investigated. Owing to the low value of Grüneisen's constant and the very low cubic expansion of tungsten, the weakening of its roentgen interferences proved to agree well with that expected by the Debye-Waller theory. The value of the x-ray characteristic of the temperature Θ_p, determined by the slope of straight line $\ln I_T/I_{T_0} = f(T)$, proved equal to 302 ± 9°K at 300°K. The divergence between the numerical value of Θ_p and the known value of Θ is explained by the fact that for the determinations of Θ_n, Θ_n, Θ_c use is made of various averaging methods, as well as the difference in sensitivity of various methods of Θ determination to the form of the lattice phonon spectrum. The latter is proved by the calculation of Θ_p, taking into account the form of the tungsten phonon spectrum, which is close to the real one. The calculation gave a value of Θ_p equal to 315°K, sufficiently close to the experimental value. (auth)

16688 ON ENERGY LOSSES BY COMPLEX PARTICLES IN RAREFIED AND CONDENSED MEDIA. V. M. Lenchenko. p.96-104 of "Radiatsionnye Effekty v Tverdykh Telakh." Tashkent, Publishing House of Academy of Sciences, 1963. (In Russian)

Energy losses by fast particles were analyzed, neglecting velocity variations at distances exceeding the interatomic distance. (R.V.J.)

16689 COMPTES RENDUS DE LA VI^e CONFERENCE INTERNATIONALE SUR LES PHENOMENES D'IONISATION DANS LES GAZ, PARIS, 8-13 JUILLET 1963. VOLUME I. (Proceedings of the VIth International Conference on Ionization Phenomena in Gases, Paris, July 8-13, 1963. Volume I.). P. Hubert and E. Cremieu-Alcan, eds. Paris, SERMA, 1963. 489p.

One hundred and six papers and abstracts of four other papers presented at the Sixth International Conference on Ionization Phenomena in Gases are included in Volume I. Separate abstracts were prepared for 98 of the papers. The remaining 8 papers were previously abstracted for NSA. (M.C.G.)

For abstracts of individual papers see: 16056, 16057, 16058, 16059, 16060, 16061, 16062, 16213, 16351, 16690, 16691, 16692, 16693, 16694, 16695, 16696, 16697, 16698, 16699, 16700, 16701, 16702, 16703, 16704, 16705, 16706, 16707, 16708, 16709, 16710, 16711, 16712, 16713, 16714, 16715, 16716, 16717, 16718, 16719, 16720, 16721, 16722, 16723, 16724, 16725, 16726, 16727, 16817, 16818, 16819, 17098, 17193, 17194, 17195, 17196, 17197, 17198, 17199, 17200, 17201, 17202, 17203, 17204, 17205, 17206, 17207, 17208, 17209, 17210, 17211, 17212, 17213, 17214, 17215, 17216, 17217, 17218, 17219, 17220, 17221, 17222, 17223, 17224, 17225, 17226, 17227, 17228, 17229, 17230, 17231, 17232, 17233, 17234, 17235, 17236, 17237, 17238, and 17239.

16690 MEASUREMENT OF THE CROSS SECTION FOR ELASTIC SCATTERING OF SLOW ELECTRONS BY HYDROGEN ATOMS. W. L. Wiese (National Bureau of Standards, Washington, D. C.). p.5-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The cross section for elastic scattering of slow (1 ev) electrons by hydrogen atoms was measured by the electrical conductivity method, utilizing the radial distributions of temperatures and electron densities in a stabilized high current arc which were measured in an earlier experiment. The results agreed very well with recent theoretical values, but disagreed with earlier experimental work based on the same method. Possible causes for this discrepancy are discussed. (auth)

16691 IONIZATION OF EXCITED STATES OF HYDROGEN BY ELECTRON IMPACT. A. D. Stauffer and M. R. C. McDowell (Royal Holloway Coll., Eng.). p.9-12 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Tabulated Gaunt factors for the bound-free transitions of atomic hydrogen (Karzus and Latter 1962) were used to derive photoionization cross sections for the $n\ell^{th}$ state of atomic hydrogen ($1 \leq n \leq 15$). A modified Bethe approximation was used to convert these to electron impact ionization cross sections from threshold to 200 ev. For the 1s state the results were in good agreement with experiment but for the 2s and 2p states the maximum cross section lay about a factor of four below the Born approximation calculations of Swan (1955). (auth)

16692 DIABATIC EFFECT IN MOLECULAR IONIZATION BY ELECTRON IMPACT. B. Stephen Berry (Yale Univ., New Haven). p.13-14 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Ionization potentials of polyatomic molecules obtained by electron impact were generally 0.1 to 0.5 ev higher than corresponding photoionization energies. It is suggested

that an important contributor to this discrepancy is the partially diabatic character of the electron impact process. The passage time of an impacting electron with energy near the ionization threshold is comparable to or shorter than the times associated with exchange between different localized bond orbitals. Photon impact is slow compared with "delocalization time", so that photoionization takes place from Hartree-Fock orbitals, while electron impact ionization takes place from localized orbitals. Therefore, ionization potentials obtained by electron impact correspond to energies of localized orbitals, necessarily larger than energies of the higher Hartree-Fock orbitals. (auth)

16693 ELECTRON IMPACT IONIZATION OF HIGHLY EXCITED ATOMIC HYDROGEN. K. Omidvar and E. Sullivan (Goddard Space Flight Center, Greenbelt, Md.). p.15-19 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A general formula was derived for ionization of the hydrogen atom from any energy level by electron impact. This became possible by using parabolic coordinates to describe the initial and the final states of the atom in the ionization matrix instead of the usual spherical polar coordinates for the initial atomic state and parabolic coordinates for the final atomic state. The approximation used is the Born approximation in which the bombarding electron before and after collision is described by a plane wave, and the ejected electron by a Coulomb wave function. The program in progress would determine the total ionization cross sections for the first five energy levels, n = 1, 2, 3, 4, 5, of the hydrogen atom. (auth)

16694 ELECTRON COLLISIONS WITH ATOMIC AND MOLECULAR OXYGEN. W. L. Fite and R. T. Brackmann (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.21-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The production of positive and negative ions in electron collisions with atomic and molecular oxygen was examined through mass-spectrometric monitoring of beams issuing from rf gas discharges and a thermal dissociation furnace. Detection of both electronically and vibrationally excited molecules was made through positive ionization. Some details of the threshold ionization of ground state atomic oxygen are presented. It was found that production of O^- in electron collisions with excited O_2 is enhanced over the case involving ground state O_2, and dissociative attachment seems to be shifted downward by approximately 2 ev in incident electron energy. Ionization efficiency curves near threshold are given for several inert-gas-excited metastable atoms. (auth)

16695 IONIZATION OF ATOMS AND DIATOMIC MOLECULES BY ELECTRON IMPACT. STUDIES OF H_2 WITH A TOTAL IONIZATION APPARATUS. Donald Rapp and Paula Englander-Golden (Lockheed Missiles and Space Co., Palo Alto, Calif.). p.27 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

An apparatus similar to that of Tate and Smith (Phys. Rev. 39: 27(1932)) was constructed and used for redetermination of total ionization efficiencies of diatomic molecules. In helium, a typical saturation curve of ion current vs potential across the parallel plates was found to be similar to that obtained by Smith. Similar measurements were made in H_2. For low electron energies, the saturation curve was similar to that obtained in He. At high electron energies, the saturation curve reached a preliminary plateau, but then rose again, reaching a final plateau with about 26 volts across the plates. (M.C.G.)

16696 IONIZATION CROSS SECTION NEAR THE THRESHOLD FOR THE RARE GASES. R. K. Asundi (Univ. of Liverpool). p.29-32 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Ionization cross sections in the five rare gases were measured in a small energy region close to the threshold. A quasi-monochromatic electron beam obtained by a retarding potential difference technique, was used. The cross-section curve in helium supported a linear threshold law. Neon and argon revealed complex structures. Onset ionization potentials at 0.8 and 1.6 ev in neon and at 0.8 and 1.45 ev in argon above the threshold were observed. The data in krypton and xenon can be approximated by ionization processes with onsets at the $^2P_{\frac{3}{2}}$ and the $^2P_{\frac{1}{2}}$ ground state of the ion. The relative probabilities of the ionization processes to these states were evaluated and compared with other measurements. (auth)

16697 STRUCTURE BEYOND THE IONIZATION LIMIT IN INELASTIC ELECTRON SCATTERING IN THE RARE GASES. C. E. Kuyatt and J. Arol Simpson (National Bureau of Standards, Washington, D. C.). p.33-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The intensity of inelastic scattering of electrons with 500 to 1000 ev primary energy by rare gases was examined in an electron spectrometer with a resolution of ~0.7 ev. At energies beyond the first ionization limit, structures localized in energy were detected. The structures in argon, neon, krypton, and xenon occurred in a region a few ev below the L_1, M_1, N_1, and O_1 ionization edges respectively, and probably corresponded to discrete autoionizing states of the inner electron involved. The structure in helium was discussed recently in Fano, and arises from interference between a two-electron autoionizing state and a continuum. Because energy losses corresponding to extreme ultraviolet transitions are easily accessible, electron scattering provides a versatile method for the study of effects far out in the continuum. (auth)

16698 FORMATION OF MULTIPLE CHARGED IONS BY THE AUGER EFFECT IN SOME MONOATOMIC GASES. Florence Fiquet-Fayard and Jean-Pierre Ziesel (Faculté des Sciences, Orsay, France). p.37-40 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

Ionization efficiency curves are given for Ar, K, Ca, Zn, Kr, Rb, and Sr. Their shape is characteristic of an important Auger effect: at the onset of the curve, "fundamental" ions are produced by simultaneous ejection of the electrons, but above the threshold for inner shell ionization, other ions appear, produced by Auger cascading. These Auger ions are often more abundant than the fundamental ions. For example, at 500 ev the ratio of the number of Auger ions to the number of fundamental ions is 400% in Zn^{3+}, 210% in Rb^{3+}, 230% in Kr^{3+}, 400% in K^{4+}, and 120% in Ca^{4+}. For Ca^{2+} and Sr^{2+} the Auger ions are predominant. (auth)

16699 RECENT STUDIES OF VIBRATIONAL EXCITATION OF N_2 BY ELECTRON IMPACT. G. J. Schulz (Westinghouse Research Labs., Pittsburgh). p.41-2 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The vibrational excitation of nitrogen molecules by electron impact was studied at an electron angle of 72° using a

double electrostatic analyzer. Results are shown in graph form. (M.C.G.)

16700 SPECTROSCOPIC STUDY OF INELASTIC COLLISIONS BETWEEN ELECTRONS AND SOME MOLECULES. M. Horani, S. Leach, and J. Rostas (Laboratoire de Chimie-Physique, Orsay, France). p.45-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

An apparatus for the study, by optical emission spectroscopy, of the interaction of a stream of molecules and a crossed beam of low-energy electrons (10 to 1000 ev) is described. This provides a spectral source for obtaining emission spectra of polyatomic molecules and ions without concomitant observation of dissociation products. The emission spectra of CO_2^+ and N_2O^+ are discussed. Spectra are reported for COS^+, SH^+, and H_2S^+. A study on H_2O as a function of electronic energy is described and 4 dissociative reactions for H_2O are discussed. Evidence for the direct reaction $H_2O + e^- \rightarrow OH(A^2\Sigma) + H(N \geq 3) + e^-$ at $E \geq 22$ ev is presented. Abnormal rotation of the $OH(A^2\Sigma)$ radicals was observed and is discussed. (auth)

16701 SIMULTANEOUS MEASUREMENT OF IONIZATION EFFICIENCY CURVES FOR POSITIVE AND NEGATIVE IONS. Hågon Sjoegren (Royal Inst. of Tech., Stockholm). p.49-50 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

An apparatus is described that makes it possible to calibrate the voltage scale with the aid of positive ions, when studying electron capture curves for negative ions from the same molecule. (M.C.G.)

16702 DETERMINING THE AVERAGE CROSS SECTION OF COLLISIONS OF ELECTRONS WITH NEUTRAL ATOMS OF A TWO-COMPONENT SLIGHTLY IONIZED GASEOUS MIXTURE. E. P. Zimin and V. A. Popov. p.51-2 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Experiments aimed at determining the average cross sections for collisions of electrons with neutral atoms at temperatures ranging from 1900 to 2300°K are described. The cross sections were determined by the data on radio wave attenuation in combustion products of a methane-oxygen mixture with potassium seeding. (M.C.G.)

16703 FORMATION OF NEUTRAL ATOMIC HYDROGEN BEAMS. C. F. Barnett, Mozelle Rankin, and J. A. Ray (Oak Ridge National Lab., Tenn.). p.63-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Measurements were made of the fraction of a fast hydrogen beam that exists in the neutral charge state after passing through hydrogen gas or through water vapor. Triatomic and diatomic hydrogen ion beams, with energies from 60 to 400 kev, were passed through a windowless, differentially-pumped gas cell, and then electrostatically analyzed. The pressure in the gas cell was sufficiently high to establish equilibrium between competing dissociation, electron capture, and electron loss collisions. Solution of the five coupled differential equations describing the formation of H^0 in hydrogen is compared with the experimental results. The fraction of neutrals formed varied as Ae^{-Bv} where A and B are constants for each gas, and v is the incident particle velocity. The number of atoms formed per incident H_3^+ ion in water vapor decreased from 2.2 at 60 kev to 0.55 at 400 kev. Measurements of the H^0 spatial distribution indicated a half angle of divergence of 20 milliradians from the dissociation of 60-kev H_3^+ in a thin target. (auth)

16704 ABSOLUTE MEASUREMENT OF THE CROSS SECTION FOR PRODUCTION OF HYDROGEN ATOMS IN THE 2S STATE. F. Cristofori, G. E. Frigerio, N. Molho, and P. G. Sona (Università, Milan). p.69-71 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A beam of hydrogen atoms excited in the metastable 2S level was produced by the charge-exchange mechanism starting from a beam of protons which passed through a chamber containing a gas at the pressure of about 10^{-3} mm Hg. Measurements of the cross section were made by varying the energy of protons from 7 to 40 kev for impact on hydrogen and helium gases. As these measurements could have an absolute value, it was necessary to evaluate the efficiency of the Lyman alpha detector (1216 Å) for alpha particles coming from the metastable atoms in their decay. This detector is a magnetic photomultiplier, and a filter with two windows of LiF, filled with oxygen at atmospheric pressure. Using the value obtained, it was possible to have an absolute measurement of the cross section of the process of interest. Comparison with the theoretical values calculated with Born's approximation showed that this cross section was lower than the value obtained from theory. (auth)

16705 ELECTRON CAPTURE INTO AN EXCITED STATE BY H^+ AND He^+ INCIDENT ON H_2 AND NOBLE GASES (5-35 kev). F. J. de Heer, J. van Eck, and J. Kistemaker (Laboratorium voor Massascheiding, Amsterdam). p.73-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

When passing H^+ or He^+ (5 to 35 kev) through H_2, He, Ne, or Kr gas the ion can capture an electron from the target atom into an excited state of H and He. The spectral lines from these fast neutrals were observed in the far ultraviolet region by means of a vacuum spectrograph. An absolute calibration of the light intensity was performed, so that absolute excitation cross sections are given. They are compared with the theoretical values of Mapleton for H^+ on He. Supplementary results for He^+ on Ne between 2000 and 6400 Å showed many maxima in the cross sections at low energy. (auth)

16706 ENERGY TRANSFER IN FAST MOLECULAR ION COLLISIONS. Hirsch I. Mandelberg and Louis Witten (RIAS, Baltimore). p.77-82 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A beam of fast molecular ions of the species H_2^+ and H_3^+ in the energy range from 25 to 76 kev was incident on a target of hydrogen gas. The products of these collisions were spectroscopically examined. One of the collision products was a fast, excited hydrogen atom, the velocity of which was determined from the doppler shift of the Balmer H_α line at 6563 Å. The velocities of these atoms, expressed in terms of the incident molecular ion energies, were found to be on the order of $1.0 \pm .1$ kev less than the velocities of the incident molecular ions. The energy defect was somewhat greater for H_3^+ incident ions than for H_2^+. (auth)

16707 MASSIVE CONVERSION OF 750-kev IONS TO NEUTRALS OF QUANTUM LEVELS >7. John S. Luce and John L. Hilton (Aerojet-General Nucleonics, San Ramon, Calif.). p.83-90 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Research was carried out on conversion of energetic

molecular ions to excited neutrals. Conversion experiments using a gaseous discharge are being conducted. These experiments allow electron, ion, neutral, and radiation interactions with a 750 kev molecular hydrogen ion beam. Measurements of neutral excitation were made by using an electrostatic gap of the type used by Sweetman. Such a gap simulated the Lorentz force experienced by excited neutrals passing through a magnetic field. The resultant beams were magnetically separated and measured by foil-covered detectors. Direct magnetic ionization of the excited neutral beam was used to confirm the electrostatic measurements. Spectroscopic analysis was also planned for exact determination of the excited states. The data from these gaseous discharge experiments were compared to data obtained in gas cell experiments. (auth)

16708 ON THE RESONANT TRANSFER OF ELECTRIC CHARGE IN MONOATOMIC GAS. Eugen Badareu and Dumitru Ciobotaru (Inst. for Atomic Physics, Academy of the R.P.R., Bucharest). p.97-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The data on resonant charge transfer cross section, obtained by various experimental methods (retarding field, similarity parameters of the abnormal glow discharge, and positive ion mobility), were found to be in good agreement with the expression $Q^{\frac{1}{2}} = A - B \log u$, for rare gases and mercury vapor, in the range 10^4 to 10^8 cm/s for the relative ion-atom velocity u. (auth)

16709 THE IONIZATION OF EXCITED HYDROGEN ATOMS BY STRONG ELECTRIC FIELDS. A. C. Riviere and D. R. Sweetman (United Kingdom Atomic Energy Authority, Culham, Abingdon, Berks, Eng.). p.105-10 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Ionization of excited hydrogen atoms by electric fields of up to 1.2×10^5 volt/cm was observed. The differential rate of ionization as a function of field was obtained by a modulated field technique and the results showed the individual levels of the atom with quantum numbers in the range n = 9 to n = 22. The identification and position of each level as a function of electric field are discussed and compared with quantum theory predictions. The Lorentz force ev × B was found to be equivalent to a pure electric field for the ionization of 50 kev hydrogen atoms. The formation of excited atoms by electron capture was studied for 100 kev deuterons in H_2, He, Ne, Ar, Kr, and Xe. The results for the sum of the populations of the levels with n = 8, 9, 10, and 11 are presented. (auth)

16710 CHARACTERISTIC ENERGY LOSSES IN SINGLE COLLISIONS OF ATOMIC PARTICLES. V. V. Afrosimov, Yu. S. Gordeev, M. N. Panov, and N. V. Fedorenko (Ioffe Physico-Technical Inst., Academy of Sciences, U.S.S.R.). p.111-15 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A method was developed for the investigation of elementary events of atomic collisions by recording both the projectile and the target particles using the coincidence techniques. The analysis of the final charge states of the particles permitted the type of the fundamental process of a charge state change to be determined directly, whereas the analysis of particle scattering enables the impact parameter, the distance of closest approach between the nuclei, and the inelastic energy loss for an elementary collision event to be found. Data are given on inelastic energy losses for a large number of concrete fundamental processes taking place during interaction of atoms and ions of argon with an energy of 50 kev with argon atoms. It was found that in collisions with impact parameters smaller than atomic dimensions the inelastic energy loss may have several discrete values for each fundamental process. The excess energy loss (i.e. the inelastic energy loss less the ionization energy loss) had characteristic values identical for all fundamental processes, which did not depend on the impact parameter and the distance of closest approach between the nuclei of the particles involved. (auth)

16711 BASIC RELATIONS FOR COULOMB INTERACTION AND ITS APPLICATION TO ATOMIC COLLISIONS. Michal Gryzinski (Inst. for Nuclear Research, Swierk, Poland). p.117-21 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Relations between energies and angles in two-particle collisions are given for the case of conservative forces. They were derived in the laboratory system of coordinates, since this system is of the prime importance for the interpretation of experimental results. Using these relations, cross sections for Coulomb collisions in which the colliding particles experience given changes in velocity were derived. These cross sections were used to determine various cross sections for inelastic atomic collisions. The results form the basis for discussion of the following cases: ionization of atoms and molecules, including inner shell ionization and double ionization, by light as well as heavy particles; excitation of atomic levels, due to the exchange and without exchange; capture of electrons by heavy particles; stopping power of medium for heavy charged particles; and scattering of electrons on atoms. It is shown that the diffraction pattern of particles scattered inelastically by atomic systems can be explained on the basis of corpuscular mechanics; it is due to discrete electronic energy states of the scatterer, and in the case of crystals, to the anisotropic distribution of the velocities of its electrons. (auth)

16712 POSITIVE ION STRIPPING STUDIES IN THE ENERGY RANGE 100-450 kev. A. R. Lee and H. B. Gilbody (University Coll., London). p.123-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Cross sections for the loss of one and two electrons in stripping processes were determined for ions of the rare gases and hydrogen. In all the cases investigated the stripping cross sections increased with increasing energy. For the same target gas, stripping increased with the atomic number of the primary ion. (M.C.G.)

16713 STUDY OF DISCRETE ENERGY LOSSES OF A FAST PROTON BEAM PASSING THROUGH A TARGET GAS. Michel Barat and Jacques Baudon (Faculté des Sciences, Orsay, France). p.127-30 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

An apparatus for the investigation of discrete energy losses of a proton beam passing through gases, is described. For the investigation of these energy losses (few ev), a high resolution would be necessary. By decelerating the ions to a low, well-defined energy (2 kev), the energy spectrum was not changed and the required resolution was smaller than few 10^{-3}. The energy losses in air, nitrogen, oxygen, hydrogen, and rare gases were studied. The results are compared with those obtained by other authors. (auth)

16714 ON THE DEGREE OF POLARIZATION OF LYMAN-α RADIATION EMITTED BY HYDROGEN ATOMS

EXCITED BY IMPACT. J. W. R. Fennema (Laboratorium voor Massascheiding, Amsterdam). p.131-3 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Percival and Seaton showed that the degree II of Lyman α radiation emitted by a hydrogen atom excited by impact, can be given in terms of the cross sections $\sigma_{\pm 1}$, σ_0, in which ± 1.0 refer to the magnetic quantum number m of the atomic electron. By using a tentative Born approximation model, an attempt was made to represent II analytically as a function of the velocity and mass of the impacting particle. At threshold and at high impact energies II appeared to be mass independent, whereas in the intermediate region a very pronounced influence of the mass was found. (auth)

16715 PHOTODETACHMENT FROM C^-. V. P. Myerscough and M. R. C. McDowell (Royal Holloway Coll., Eng.). p.135-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Photodetachment cross sections for C^- at photon energies from threshold to 3 ev were evaluated in both dipole length and dipole velocity formulations, with several choices of bound and of free wave functions. The effects of the polarization contribution to the interaction are discussed. A representation of this interaction correct in the limit of both small and large r was adopted. The calculations are compared with those of previous workers and with experiment. (auth)

16716 AUTOIONIZATION IN HELIUM USING A SYNCHROTRON LIGHT SOURCE. R. P. Madden and K. Codling (National Bureau of Standards, Washington, D. C.). p.139-43 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A 180-Mev electron synchrotron was used as a pure continuum light source to study the absorption spectrum of He in the 200 Å region. A series of anomalies in the continuous photoionization absorption was observed, corresponding to transitions from the ground state to two-electron excitation states in He. The shapes of these anomalies were determined by the interference of these discrete states with the neighboring continuum, and are in qualitative agreement with theoretical predictions for transitions to autoionizing levels. Quantitative data on the distribution of oscillator strength in these anomalies and the autoionization probability of the two-electron excitation states are presented. (auth)

16717 HELIUM AND ARGON EMISSION CONTINUA AND THEIR USE IN ABSORPTION CROSS-SECTION MEASUREMENTS IN THE VACUUM ULTRAVIOLET. R. E. Huffman, Y. Tanaka, and J. C. Larrabee (Air Force Cambridge Research Labs., Bedford, Mass.). p.145-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Helium and argon continua light sources were improved for use as the background in absorption cross-section measurements in the vacuum ultraviolet. The light sources developed have sufficient intensity and stability for use with a photoelectric, wavelength scanning technique at a band width of 0.5 Å. The helium continuum is useful from 580 to 1100 Å and the argon continuum from 1070 to 1500 Å. As an example of their use, absorption cross-section measurements of argon, krypton, and xenon both in the ionization continua and in the autoionized lines between the $^2P_{\frac{3}{2}}$ and $^2P_{\frac{1}{2}}$ ionization thresholds are discussed. (auth)

16718 IMPROVED PHOTOIONIZATION AND ABSORPTION SPECTRA OF SEVERAL GASES IN THE 600 TO 1000 Å REGION. G. R. Cook and P. H. Metzger (Aerospace Corp., El Segundo, Calif.). p.149-52 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Absolute photoionization and absorption cross sections of N_2, H_2, and H_2O were measured with a resolution of 0.5 Å. The absolute photon flux was determined by calibrating the ion chamber with the rare gases A, Kr, and Xe. The N_2 and H_2 absorption spectra were characterized by band structure superimposed on a continuum, and, in the short wavelength region, by the continuum alone. Only continuous absorption was observed for H_2O. For all three molecules, the structure of the photoionization and absorption cross sections was similar beyond the ionization potential, but of different magnitude, indicating an ionization efficiency of less than 100%. (auth)

16719 HELIUM METASTABLE ADMIXED GAS REACTIONS IN A FLOW SYSTEM. C. B. Collins and W. W. Robertson (Univ. of Texas, Austin). p.153-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The selective excitation of spectra of nitrogen, oxygen, and carbon monoxide by active helium species was examined in a flowing helium afterglow. The apparatus was arranged so that the active species could be removed from a discharge in relatively pure helium and caused to react with the second gas in a concentric flow burner a considerable distance downstream. The observed spectra were emitted from the zone of mixing, giving it the appearance of a bright conical flame. Two classes of reactions were observed, those characteristic of higher pressures (30 to 40 mm Hg) and those characteristic of lower pressures (5 to 15 mm Hg). The examination of the spectra at different pressures and different decay times in the afterglow, together with the quenching effects of a microwave field imposed between the discharge and burner, served to identify the low-pressure reactions as being Penning-type reactions with helium 2^3S metastable atoms. Similarly, the high-pressure reactions were found to be charge-exchange reactions between He_2^+ and the admixed gas. (auth)

16720 ON ION FORMATION IN KRYPTON, ARGON, AND ARGON–NITROGEN MIXTURES. F. J. Comes (Universität, Bonn). p.159-62 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In German)

Electron impact experiments in Kr, Ar, and N_2–Ar mixtures under elevated pressures in the ion source of a mass spectrometer give information on the kind of excitation and the mechanism of the secondary ion formation. The measurements showed that there are several excited states of different lifetime in Ar and Kr capable of forming the molecular ion. In collisions of the second kind more reactive states can be formed leading to a third order pressure dependence of the molecular ion formation. N_4^+-formation was compared in pure N_2 and Ar–N_2 mixtures. Ar^+ and Kr^+ ions from doubly ionized Ar and Kr atoms formed in their own gases by a charge transfer reaction showed a lack in their kinetic energy, which can be related to an excitation of the collision partners. (auth)

16721 THE LIFETIME OF EXCITED STATES IN THE NEUTRAL REACTION $X^* + Y \rightarrow XY^* + e$. W. Kaul (Physikalisch-Technische Bundesanstalt, Brunswick). p.169-71 of "VI^e Conference Internationale sur les Phe-

nomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In German)

Rare gas molecular ions observed in a mass spectrometer at source pressures below 10^{-2} mm Hg are assumed to be formed by reactions of the type $X^* + Y \rightarrow XY^+ + e$, X^* being an excited rare gas atom and Y a rare gas atom in the ground state. By means of a pulse technique, decay curves were measured which yield informations about the average lifetime of the excited partner in the reaction scheme. In the reaction $He^* + He \rightarrow He_2^+ + e$ at least two states with average lifetimes of about 2.8×10^{-7} and 2.6×10^{-6} sec were observed. In the corresponding Ar_2^+ formation the excited state decay curve can be interpreted by the assumption of three states with lifetimes of about 5.4×10^{-7}, 2.0×10^{-6}, and 1.9×10^{-5} sec. For $NeAr^+$ formation by the reactions $Ne^* + Ar \rightarrow NeAr^+ + e$ a lower limit of 10^{-4} sec for the lifetime of Ne^* can be given. Considering the previously measured appearance potential of 16.5 v one or both of the two metastable $2p^5$ 3s configurations of neon were assumed to be reacting states. (auth)

16722 REACTION RATES FOR THE FORMATION OF He_2^+ AND Ne_2^+. Earl C. Beaty and Paul Patterson (Joint Inst. for Laboratory Astrophysics, Boulder, Colo.). p.289-93 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Reaction rates for the conversion of atomic ions on He and Ne to molecular ions were measured. The rate for He^+ was shown to be quadratic in the pressure with the result ($108\ p^2$) about 60% higher than that reported by Phelps and Brown. Mobility data for helium were quite analogous to that reported previously for argon. Three mobilities were found, which seem to be characteristic of pure helium. The values are: 10.5, 16.7, and 20 cm^2/volt/sec. The ion of intermediate mobility was, as with argon, the one that was chemically stable in the pure gas. The slowest ion was He^+ and it was observed to react with the gas to produce the ion of mobility 16.7. This reaction can be reversed at some values of pressure and electric field. The implication is strong that the ion mobility 16.7 is He_2^+, and, if it is not He_2^+, it is almost certain that He_2^+ is an intermediate step in its formation. The identity of the ion of mobility 20 is unknown. It disappears very quickly from the afterglow; however, diffusion coefficient measurements seem to demonstrate that it is not doubly charged. The mobility, 20, agrees well with that measured by Biondi and Chanin, and assumed by them to be He_2^+. Data on neon are analogous except the expected high-mobility short-lived ion has a mobility quite close to the chemically stable ion. The neon data were not analyzed as completely as that for helium, however a preliminary analysis yielded 4.0 and 6.2 for the mobilities of the neon atomic and molecular ions respectively. The rate of conversion of neon atomic ions to molecular ions was about half the corresponding rate for helium. (auth)

16723 A NEW METHOD OF MEASURING ELECTRON DRIFT VELOCITIES. J. M. Breare and A. von Engel (Oxford Univ.). p.317-19 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The motion of a pulse of electrons through hydrogen was studied by observing the radiation produced when molecules, excited by electron collisions, decay to lower levels. The method requires the use of a fluorescent substance, photomultiplier, and fast oscilloscope to obtain the time resolved spatial distribution of the light. The nature and intensity of the light, which is predominantly in the ultraviolet region, is discussed. Preliminary results of drift velocity measurements compared favorably with previous determinations using conventional methods. (auth)

16724 THE RATIO OF DRIFT SPEED TO DIFFUSION COEFFICIENT FOR QUASI-THERMAL ELECTRONS IN NITROGEN AND HYDROGEN. R. W. Crompton and M. T. Elford (Australian National Univ., Canberra). p.337-41 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Experimental procedures are described which enable the ratio W/D to be determined with an error of less than 1% for electrons whose energy exceeds thermal energy by as little as 3%. The elimination of several factors likely to be responsible for the discrepancies in existing data is described together with a means of checking the overall accuracy of the method by means of thermal K^+ ions. Results are presented for electrons diffusing in hydrogen and nitrogen at 293°K; in hydrogen the results cover the range $0.006 < E/p < 0.1$ volt cm^{-1}(mm Hg)$^{-1}$ and in nitrogen $0.006 < E/p < 5.0$ volt cm^{-1}(mm Hg)$^{-1}$. (auth)

16725 ON RESONANT CHARGE TRANSFER IN IONIZED DENSE GASES. Lucian Brandus and Iovitzu Popescu (Inst. for Atomic Physics, Academy of the R.P.R., Bucharest). p.343-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol I." Paris, SERMA, 1963.

The mechanism of positive charge conductivity of ionized dense gases on the basis of the resonant charge transfer process is considered. Starting from both Einstein and Kubo-Greenwood theories for kinetic coefficients and using the hydrogen molecule-ion approximation, practically the same conclusion was arrived at: the mobility (or conductivity) increases quasi-exponentially with the decrease of the mean distance between atoms. For sufficiently dense gases it becomes several orders of magnitude higher than the common mobility of rare gases, governed by the ion motion. (auth)

16726 UPPER LIMIT TO THREE-BODY ELECTRON-ION RECOMBINATION RATE. Robert C. Stabler (RCA, Princeton, N. J.). p.449-50 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The rate of three-body electron-electron-ion recombination (or collisional-radiative decay) was calculated for the case of a continuous distribution of atomic energy levels. The rate was found to be independent of the level spacing in this limit. The rates obtained were actually smaller than the rates found by Bates, Kingston, and McWhirter for the case of low temperatures. Hence it was concluded that recombination resulting from collisional-radiative decay is not significantly faster for molecular ions than for atomic ions, nor is it faster in the presence of external fields. (auth)

16727 CHARGE EXCHANGE BETWEEN IONS AND ATOMS OF ALKALINE AND ALKALINE-EARTH METALS. D. V. Tchkouaceli, A. I. Gouldamachvili, and U. D. Nikoleychvili (State Committee for the Utilization of Atomic Energy, Moscow). p.475-9 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

An examination was made of the relation between results obtained in measurements of the effective cross section for charge exchange for $Rb^4 \rightarrow Cs$, $K^4 \rightarrow Cs$, $Na^4 \rightarrow Cs$, $Ca^4 \rightarrow Cs$, and $Mg^4 \rightarrow Cs$ for which the resonance energy deficiency, $\Delta E > 0$ and for $Cs^+ \rightarrow Rb$, $Cs^+ \rightarrow K$, and $Cs^+ \rightarrow Na$ for which $\Delta E < 0$. (M.C.G.)

Cosmic Radiation

16728 (BNL-7534(p.2-28)) RECENT COSMIC-RAY RESULTS AT ULTRA-HIGH ENERGIES. R. Levi Setti (Chicago. Univ.).

The fragmentation of heavy cosmic nuclei in the region between 1 and 15 Tev and the nature of secondaries produced in jets at energies greater than 1 Tev are discussed from specific experimental evidence. (R.E.U.)

16729 (BNL-7534(p.29-38)) CAN COSMIC RAYS REPLACE ACCELERATORS? L. W. Jones (Michigan. Univ., Ann Arbor).

The possibility of using cosmic rays in high-energy experiments instead of accelerator sources is discussed. An array of spark chambers and large magnets deployed vertically above and below a liquid-hydrogen target with suitable triggering counters and electronics is considered. The determination of the width parameter for the diffraction peak in proton-proton diffraction elastic scattering at 300 Bev is considered. (R.E.U.)

16730 (FTD-TT-64-90) COSMIC RESEARCH. Translation of Kosmicheskie Issledovaniya, 1: No. 3, 339-480(1963). 250p.

Ten papers are presented on cosmic research. Individual abstracts are prepared for four papers. Papers not abstracted consider rotation of a dynamically symmetrical satellite, radiant fluxes onto orientated surfaces, radiation balance of the earth's surface-atmosphere system, geographic-geological methods of studying the moon, and structural elements of the moon. (L.B.S.)

For abstracts of individual papers see: 16553, 16554, 16731, and 16732.

16731 (FTD-TT-64-90(p.110-27)) ON THE DENSITY DISTRIBUTION AND INTENSITY OF CHARGED PARTICLES WITHOUT TAKING INTO ACCOUNT INTERACTION IN A STATIONARY GEOMAGNETIC FIELD. V. D. Pletnev. (Translation).

An asymptotic method of solving the Boltzmann equation for a low-density ionized gas in a strong stationary magnetic field is used to estimate the density distribution and intensity of charged particles in the Van Allen radiation belts. This method, which is based on expansion of the distribution function of charged particles with respect to the inverse powers of the Larmor frequency, is applicable when conserving the invariant of the longitudinal effect of a particle in a magnetic field. For this, additional averaging of the distribution function is carried out for the period of vibrations of a particle between magnetic mirrors. This work examines the different possible forms of the distribution function in these approximations and their corresponding density distributions and intensity of charged particles in the field. (auth)

16732 (FTD-TT-64-90(p.163-76)) INVESTIGATIONS OF COSMIC RADIATION BEYOND THE ATMOSPHERE. N. L. Grigorov, D. A. Zhuravlev, M. A. Kondrat'eva, I. D. Rapoport, and I. A. Savenko. (Translation).

Measurements of the tracks of charged particles in an emulsion irradiated at a height of 306-339 km showed that the intensity of the recorded radiation is three times greater than the intensity of primary cosmic radiation. Nearly 50% of the excess particles were nonnuclear active particles with minimum ionization (electrons are the fastest). The remaining 50% are strongly ionized particles which are nuclear fission products. (auth)

16733 SUMMARY—IONOSPHERIC CONSTITUTION AND IONIZING RADIATIONS. H. Friedman (Naval Research Lab., Washington, C. C.). p.94-9 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

A review is given of atmospheric models, production and loss processes in the E and F layers, temperature and composition parameters of the D and F layers, solar-flare and cosmic-particle effects on the ionosphere, and data from the UK1 satellite. (T.F.H.)

16734 THE INCIDENCE OF CHARGED PARTICLES INTO THE UPPER ATMOSPHERE AND RELATIONS TO SUDDEN COMMENCEMENTS OF GEOMAGNETIC STORMS AND TO GIANT PULSATIONS AT HIGH LATITUDES. T. Sato (Japan Defence Agency, Tokyo). p.155-62 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

At high latitudes, riometer records at 27.6 Mc show an abrupt increase in ionospheric absorption at the sudden commencement of a geomagnetic storm and during the accompanying giant pulsations. The variation of absorption is closely related to the magnetic variations. Similar results have been obtained for individual giant pulsations, which occur on magnetically quiet days. From these results it is concluded that the local-disturbance electric currents, which seem to be caused in association with the increased ionization by the incident charged particles may play an important role in the formation of different types of sudden commencements and giant pulsations. (auth)

16735 COSMIC RAY HAZARDS IN THE SOLAR SYSTEM. S. N. Milford (Grumman Aircraft Engineering Corp., Bethpage, N. Y.). New York, American Inst. of Aeronautics and Astronautics, 1964, Preprint 64-66, 14p, $1.00. (CONF-392-17)

From Aerospace Sciences Meeting, New York, Jan. 1964.

The direct measurement of cosmic-ray energy and charge spectra near the earth and in the earth's atmosphere is discussed. The theories of the effects of planetary magnetic fields and atmospheres in modifying these spectra, and of the interaction of cosmic rays with the lunar surface are discussed. The cosmic-ray intensity and dose in the outer solar system are discussed using models of the interplanetary magnetic fields to give the resulting modulation of low-energy interstellar cosmic rays as a function of distance from the sun. 60 references. (R.E.U.)

Criticality Studies

16736 (HW-79413) DETERMINATION OF THE RELATIVE WORTH OF PLUTONIUM ATOMS TO U^{235} ATOMS IN HOMOGENEOUS UO_3–WATER MIXTURES. L. L. Carter (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 30, 1963. Contract AT(45-1)-1350. 11p.

The limiting enrichment of uranium for criticality and the limiting atomic ratios of Pu-to-natural uranium containing 0, 5, 10, and 15% Pu^{240} were determined by Monte Carlo techniques for UO_3–water mixtures. The Monte Carlo results predict an infinite multiplication factor of unity for a 1.001 ± 0.026 wt % enriched UO_3–H_2O mixture. This compares favorably to the experimentally determined limiting critical enrichment of 1.034 ± 0.01 wt % U^{235} in the uranium. The Monte Carlo and multigroup calculations indicate that natural uranium UO_3–H_2O mixtures with a plutonium-to-uranium atomic ratio of less than 0.00155 ± 0.00012 should have a k_∞ of less than unity when

no Pu^{240} is present. The relative worth of plutonium atoms to U^{235} atoms from a reactivity standpoint with no Pu^{240} present is 1.90 ± 0.14. This ratio changes rapidly with the percent of Pu^{240} that is present in the Pu. (P.C.H.)

16737 (HW-80213) ACCURATE EIGENVALUE MATRIX TREATMENT OF GENERAL FISSILE INTERACTION. F. R. Czerniejewski (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 1963. Contract AT(45-1)-1350. 39p.

Derivations and approximations are presented which describe the nuclear interaction between subcritical, cylindrical units of fissile material. Matrix theory is used throughout, and the interaction probability is formulated as a surface integral of the solid angle between units to yield an accuracy of ±5% on measured critical assemblies. Flexibility is extended to cover arbitrary arrangement, height, and nuclear characteristics for each unit; and the contribution of external reflectors is also accounted for. A Fortran code which uses the theory is described. (auth)

16738 (KAPL-M-6121) REACTIVITY COEFFICIENT OF ALUMINUM IN THE PMA. J. R. Chalfant and C. R. Lubitz (Knolls Atomic Power Lab., Schenectady, N. Y.). [1963]. Contract W-31-109-eng-52. 41p.

Comparisons are made between experimental and theoretical values of the distributed reactivity worth of aluminum in the polyethylene moderated slab assembly (PMA-40) core. Refinements in the calculational model and, to a lesser extent, changes in the cross section data considerably reduce the spread between theory and experiment. Since the experimental value is ~1.0¢/kg while the theory gives ~1.4¢/kg, the agreement is still not satisfactory. (auth)

16739 (NAA-SR-7541) CRITICAL EXPERIMENTS ON SLIGHTLY ENRICHED URANIUM METAL FUEL ELEMENTS IN GRAPHITE LATTICES. R. W. Campbell, R. J. Doyas, H. C. Field, C. A. Guderjahn, R. L. Guenther, D. F. Hausknecht, M. S. Mayer, and H. A. Morewitz (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 30, 1963. Contract AT-11-1-GEN-8. 38p.

A series of clean critical experiments was performed in the SGR critical facility utilizing 2 wt % enriched, uranium metal, hollow cylinder, fuel elements in AGOT graphite moderator. Six lattice spacings were used, varying from 6.93 to 16.0 in. on a triangular pitch. Critical loadings and fuel element worths were determined and compared to the results of 4-group diffusion theory. Calculations utilized TEMPEST, S_4, FORM, and AIM-5 programs on the IBM 7090. The calculated K_{eff} compared well with experiments over the full range of moderator-to-fuel volume ratios when using a 2200 m/sec graphite absorption cross section of 4.07 mb. The sensitivity of the calculation to variations in the graphite absorption cross section was examined and the experimental error due to inventory uncertainties was assessed. The differential worths of both the central and peripheral fuel elements were obtained and agreed in general with AIM-5 calculations. The thermal flux traverse of a unit cell was shown to agree best with a Wilkins' spectrum option of TEMPEST. Details of both the experimental and theoretical methods are given. (auth)

Direct Energy Conversion

16740 (AD-425231) INVESTIGATIONS ON THE DIRECT CONVERSION OF NUCLEAR FISSION ENERGY TO ELECTRICAL ENERGY IN A PLASMA DIODE. Report No. 4. Annual Report, November 1, 1962–October 31, 1963. C. B. Leffert, F. E. Jamerson, and D. B. Rees (General Motors Corp. Research Labs., Warren, Mich.). Contract Nonr-3109(00). 105p.

Experimental determinations are presented of the ion source rate generated by fission fragment ionization of noble gases. The effect of gas pressure (30–400 torr) and gas species (Ar, Ne, Xe, and Ne : Ar) on ion source rate was studied inpile with ionization chamber tubes in which thin U served as a fission source. A theory was developed for the ion chamber current-voltage characteristic, based on the assumption that the ion density in the plasma between the electrode sheaths was controlled by volume recombination loss. This theory accurately described the shape of the current-voltage curves. The values of ion source rate determined by the application of the theory to the experimental curves were in reasonable agreement with the values of source rate calculated independently from the ionization energy loss of fission fragments in the gas. For the pure gases (Ne, Ar, and Xe), the magnitude of ion source rate increased with increasing atomic mass and gas pressure. However for the Ne–Ar (1000 : 1) mixture, the ion source rate was twice that for pure neon under the same conditions. This effect was attributed to fission fragment energy loss to metastable states of the parent gas (Ne) which produced additional ionization of the trace gas (Ar) by collisions of the second kind. For a 240 torr filling and a neutron flux of 1.2×10^{13} n sec^{-1} cm^{-2}, the ion source rate was of order 10^{16} ions sec^{-1} cm^{-3}. Under these conditions, the ion density computed for the pure gases (dissociative recombination loss) was ~1.5×10^{11} ions cm^{-3}. The ion density in Ne : Ar under the same conditions was estimated to be 8.3×10^{11} ions cm^{-3}, higher than in the pure gases. This was due to the fact that the conversion rate of A^+ to A_2^+, necessary to provide A_2^+ for dissociative recombination loss, was slower in the Ne–Ar mixture than was the equivalent conversion rate of monatomic to diatomic ions in the pure gases. (auth)

16741 (BSD-TDR-63-248) EFFECT OF ELECTRODE NONUNIFORMITIES ALONG THE MAGNETIC FIELD IN MHD GENERATORS. Research Report No. 176. Frank J. Fishman, Jr. (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Nov. 1963. Contract AF04(694)-414. 15p. (AD-431895)

The current distribution in an MHD channel with a working fluid characterized by a tensor electrical conductivity is calculated for electrodes that are finely segmented in the flow direction or do not extend entirely across the channel. Fundamentally, this electrode geometry increases the normal internal impedance of the channel by an amount that is proportional to the aspect ratio of the channel, the quantity $[1 + (\omega\tau)^2]^{1/2}$, and a factor that increases monotonically with the ratio of channel width to electrode width. The circuit and efficiency characteristics of both normal and Hall current generators based on this channel are obtained. The effects of electrodes segmented coarsely in the magnetic field direction, but finely along the flow, are deduced from the fundamental solution. A comparison with the effects of coarse segmentation along the flow indicates that these latter nonuniformities may be more than four times as effective in increasing the channel impedance. (auth)

16742 (GA-4804) RESEARCH ON THERMIONIC CELL COLLECTORS. Summary Report, November 1, 1962–October 31, 1963. B. Rump, C. W. Savery, Jr., J. H. Broido, J. C. Peak, and W. B. Wright, Jr. (General

Atomic Div., General Dynamics Corp., San Diego, Calif.). Jan. 15, 1964. Contract NObs-86221. 179p.

The work functions of cesiated and cesium-hydride-coated surfaces are studied. A thermionic cell for performance analyses is described. Design characteristics of water-cooled and liquid-metal-cooled nuclear-thermionic generators for naval power applications are compared. (T.F.H.)

16743 (MHD-646) RESEARCH ON THE PHYSICS OF PULSED MHD GENERATORS. Final Report. Malcolm S. Jones, Jr., V. H. Blackman, R. C. Brumfield, E. W. Evans, and C. N. McKinnon (MHD Research, Inc., Newport Beach, Calif.). Dec. 1963. Contract Nonr-3895(00). 164p.

Two systems for producing short pulses of electrical power by MHD principles are discussed. The first system is driven by condensed explosives and produces pulses lasting from 1 μsec to 100 μsec. The peak power generated to date is 23 Mw, with an energy output of 750 joules. The conversion efficiency, chemical to electrical, is 1%. Higher conversion efficiencies can be readily achieved. The second system uses the combustion of aluminum with cesium nitrate as the energy source for a supersonic MHD channel. The measured conductivity of the combustion products was 1000 mho/m. The highest measured peak power output was 29 w. The experimental data indicate a large electrode drop which must be overcome before currents can flow in the generator. A favorable scaling potential is indicated. (auth)

16744 (TRW-ER-5802) HIGH-TEMPERATURE SOLAR THERMIONIC GENERATORS. Third Quarterly Technical Report, November 1, 1963–January 31, 1964. (Thompson Ramo Wooldridge Inc. TRW Electromechanical Div., Cleveland). Feb. 1964. Contract AF33(657)-11169. 72p.

A total of 2322 hours of continuous operation was recorded for thermionic converter #302 with no apparent degradation in output power. This converter is operating at an emitter temperature of 2000°K with a power output of 18.2 watts (0.7 V @ 26 amps). Converters #303 and #305 which were undergoing cyclic testing to simulate the 55 minute ON, 35 minute OFF orbital cycle operation, failed at 430 cycles (645 hours) and 624 cycles (936 hours) respectively. The metallographic analyses of these failed converters revealed significant limitations of the Series 300 converter when subjected to cyclic operation. Although many life-limiting features of the design were determined, it was concluded that the actual failures, which occurred at the seal metal-to-ceramic brazes, resulted from having overheated the seal structures during acceptance testing. Based on the evaluation of the test histories and failure analyses of converters #303 and #305, a modified converter design was prepared. The fabrication and acceptance test of three converters (Nos. 311, 312, and 313) was completed. Converter #312 is scheduled for continuous life evaluations while converters #311 and #313 will be cycle life evaluated. These converters are currently being installed in the VAC-ION Life Test Stand. The preliminary design of a solar thermionic generator was also completed during the past quarter and this design dictated the shape of the Series 310 converter emitter head to conform to a four converter generator cavity wall. The generator, with emitters operating at 2000°K, is rated at 66 watts @ 4.0 volts or 108 watts at 3.0 volts. The generator assembly utilizes four Series 310 converters arranged symmetrically about the solar concentrator optical axis such that the emitters form a solar cavity receiver. The configuration is such that any converter can be removed and replaced with a minimum of difficulty. The ground rules established prior to the initiation of the generator design calculation are presented. (auth)

16745 CONVERSION OF ALPHA PARTICLE KINETIC ENERGY INTO ELECTRICITY. A. M. Plummer and J. N. Anno. 21p. (CONF-414-4)

From Conference on Direct Energy Conversion, Argonne, Ill., Nov. 1963.

An alpha-electric cell designated the Triode because it has an emitter, grid, and collector is described. Characteristics and operational results are discussed. (R.E.U.)

16746 GERMANIUM CELLS FOR RADIANT ENERGY CONVERSION. G. C. Jain (Purdue Univ., Lafayette, Ind.). 10p. (CONF-414-3)

From Conference on Direct Energy Conversion, Argonne, Ill., Nov. 1963.

The maximum available power densities, the efficiency for a black body source operating at 2000°K, and the conversion efficiency of solar radiation using germanium photoelectric cells are discussed. Conversion from fossil fuels or nuclear sources is discussed. (R.E.U.)

Elementary Particles and Radiations

16747 (BNL-7534(p.49-80)) SCATTERING AT VERY HIGH ENERGIES. S. C. Frautschi (California Inst. of Tech., Pasadena).

The high- and low-energy aspects of dispersion theory of strong interactions are discussed. Nearly elastic and highly inelastic scattering at high energies are discussed. (R.E.U.)

16748 (BNL-7534(p.81-2)) SOME ASPECTS OF STRONG-INTERACTION THEORY THAT CAN BE STUDIED AT HIGH ENERGIES. S. C. Frautschi (California. Inst. of Tech., Pasadena).

The systematic description of scattering in terms of particle exchanges with Regge poles theory is discussed. Consequences of the Regge-pole assumption are discussed. (R.E.U.)

16749 (BNL-7534(p.83-7)) ELASTIC SCATTERING OF $\pi^{\pm}$-p, $K^{\pm}$-p, $\bar{p}$-p, AND p-p WITH A 600 TO 1000-Bev ACCELERATOR. W. J. Willis (Brookhaven National Lab., Upton, N. Y.).

The possibility of measuring elastic scattering cross sections for small momentum transfer with a 600- to 1000-Bev accelerator is discussed. (R.E.U.)

16750 (BNL-7534(p.88-106)) WEAK-INTERACTION EXPERIMENTS WITH 1000-Bev ACCELERATOR. N. P. Samios (Brookhaven National Lab., Upton, N. Y.).

The theoretical interest behind weak-interaction experiments for neutrinos is discussed. The scattering of μ-neutrinos by protons and neutrons and of anti-μ-neutrinos by protons is discussed. (R.E.U.)

16751 (BNL-7534(p.238-52)) P-P ELASTIC SCATTERING WITH COLLIDING BEAMS. K. M. Terwilliger (Michigan. Univ., Ann Arbor).

The sufficiency of colliding-beam techniques for studying p-p elastic scattering in the diffraction region is demonstrated. The advantages and disadvantages of using the center-of-mass rather than the laboratory system are discussed. (R.E.U.)

16752 (BNL-7534(p.308-11)) POSSIBLE USE OF COLLIDING BEAMS TO STUDY THE INTERMEDIATE BOSON. B. Thevenet (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay).

The use of colliding beams to study the electromagnetic production of the proposed intermediate boson (W) is discussed for $\bar{p}p \rightarrow W^+W^- \rightarrow e^{\pm}\nu\mu^+\bar{\nu}$, $e\nu e\nu$, or $\mu\nu\mu\nu$. (R.E.U.)

16753 (BNL-7534(p.312-17)) MISCELLANEOUS COMMENTS ON COLLIDING BEAMS. L. W. Jones (Michigan. Univ., Ann Arbor).

Space-charge limits of injection energy, beam-beam defocusing effects, bunching of the stacked beam with r-f, and circumference effects on stacking and energy spread in storage rings are discussed for proton synchrotrons. (R.E.U.)

16754 (CERN-64-13(Vol.I)(p.177-87)) LORENTZ TRANSFORMATIONS FOR GENERAL COLLISION. (European Organization for Nuclear Research, Geneva).

The transformations necessary to treat the most general collision of two arbitrary particles in a completely relativistic manner are described. The effects of the transformations are indicated by diagrams. (D.C.W.)

16755 (CERN-64-13(Vol.II)(p.1-73)) NOTES ON PHASE SPACE. O. Skjeggestad (European Organization for Nuclear Research, Geneva and Oslo. Universitet, Blindern. Fysisk Institutt).

The general phase space formula for a system of n particles in the final state is derived, and the expression for non-invariant 2-body phase space is obtained. The Lorentz invariant expression for 2-body phase space is then evaluated, and a recursion relation is used to derive the Lorentz invariant 3-body phase space. The angular distribution between any two particles in the center-of-mass of the n particles is then calculated, as is the effective mass distribution of any number of particles. The effect of a resonance between two particles on the effective mass distribution of any two particles in the final state is also investigated; and the properties of 3-body phase space used in the Dalitz representation are discussed. Some predictions from phase space are compared with experimental data on hyperon resonances. (auth)

16756 (CERN-64-13(Vol.II)(p.75-111)) DETERMINATION OF THE Ξ DECAY PARAMETERS. W. Koch (European Organization for Nuclear Research, Geneva).

The theoretical bases for the determination of the decay parameters describing the wave function of a nonleptonic, weak, two-body decay from angular distribution and polarization measurements are developed. The decay $\Xi \rightarrow \Lambda + \pi$ is used as an example, assuming that both the Ξ and Λ have spin $\frac{1}{2}$. The latest values for the parameters are included. (D.C.W.)

16757 (CERN-64-13(Vol.II)(p.113-92)) SOME METHODS OF SPIN DETERMINATION OF ELEMENTARY PARTICLES AND RESONANCES. W. Koch (European Organization for Nuclear Research, Geneva).

Some techniques for determining the spins of particles and resonances are reviewed. (D.C.W.)

16758 (CERN-64-13(Vol.III)(p.1-79)) SELECTED TOPICS IN THE THEORY OF ELEMENTARY PARTICLES. Giovanni Costa (Padua. Universita. Istituto di Fisica).

Theory for the scattering of elementary particles is reviewed, together with the classification of elementary particles by unitary symmetries. The groups SU_2 and SU_3 are considered, and the necessary group theoretical concepts are surveyed. (D.C.W.)

16759 (CERN-64-13(Vol.III)(p.81-110)) WEAK INTERACTIONS OF NON-STRANGE PARTICLES. M. Veltman (European Organization for Nuclear Research, Geneva).

Theory for calculating the cross sections and lifetimes of processes in high-energy physics is presented. The relation between these quantities and the matrix elements of the S-matrix is given, and the Feynman rules by which matrix elements are calculated are established. The evaluation of traces is also considered. Vector boson decay into a neutrino pair and the interaction $\nu - n \rightarrow \mu^- - p$ are treated. (D.C.W.)

16760 (LAMS-3013) SOME LOW-ENERGY NEUTRINO CROSS SECTIONS. Leon Heller (Los Alamos Scientific Lab., N. Mex.). Dec. 1, 1963. Contract W-7405-eng-36. 59p.

The cross sections for neutrino and antineutrino elastic scattering on electrons and for antineutrino absorption on protons (giving a neutron and a positron) were calculated using the V-A four-fermion interaction. Recoil electron spectra are presented for the elastic scatterings; and the angular distribution of positrons is given for the absorption process, in addition to total cross sections for all these processes. Results are given analytically and in graphical form. The scattering formulas should be reliable to 50 Mev; the absorption formulas below 10 Mev. The calculations are outlined, and beta decay theory is reviewed. (auth)

16761 (NIRL/R/56) ANALYSIS OF NEUTRAL CASCADE EVENTS FROM A HEAVY LIQUID BUBBLE CHAMBER. A. G. Wilson (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Oct. 1963. 21p.

Complete neutral cascade events are observed in heavy liquid bubble chambers. Both photons from the π^0 decay are converted to electron pairs. The data for the problem consist of angles and momenta for the two charged prongs of the Λ^0 decay, angles for the photons calculated from the electron angles, and the coordinates of all the charged vertices. These are supplied by a geometrical reconstruction program. The traditional fit of a bubble chamber event to kinematical constraints is extended to include the geometrical constraint that four of the neutral tracks pass through one point. The coordinates of this point, the Ξ^0 decay vertex, and the Ξ^0 mass are varied in the fit together with the usual kinematical variables. (auth)

16762 (NP-13694) ISSLEDOVANIE POLYARIZATSII KOSMICHESKIKH MYUONOV PRI RAZLICHNYKH ENERGIYAKH I OTSENKA $K^+/K^+ + \pi^+$ OTNOSHENIYA. (Investigation of the Polarization of Cosmic Muons at Various Energies and a Determination of the Ratio $K^+/K^+ + \pi^+$). T. L. Asatiani and R. O. Sharkhatunyan (Akademiya Nauk S.S.S.R. Institut Teoreticheskoĭ i Eksperimental'noĭ Fiziki, Moscow and U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 36p.

A rectangular hodoscope using a dipole magnetic field, a circular hodoscope with symmetric geometry in relation to the absorber, and a Wilson chamber were used for measuring muon polarization for particles with 0.14, 0.25, 0.300, 1.45 and 2.0 Bev residual energy at the inlet of the installation. The residual energy was determined using moderators over the installation. Measurements at $E_\mu = 2.0$ Bev were carried out underground. Polarization was determined by measuring angular distribution asymmetry for positrons from 90000 stopped muon decays. (R.V.J.)

16763 (NP-13701) FUNKTSII GRINA I GRAFICHESKII METOD V KONECHNYKH SISTEMAKH (OBZOR). (Green's Functions and a Graphical Method in Finite Systems). (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1963. 35p.

A review is given of the development of Green's functions and graphic methods for finite systems. Green's

functions for single-particle, particle-in-field, two-particle, and pulse concepts of scattering amplitudes are analyzed as well as bound states. Green's functions for N + 1 and N particles are compared with one- and two-particle functions. (R.V.J.)

16764 (NP-13731) ETUDE EXPERIMENTALE DES DESINTEGRATIONS LEPTONIQUES DES Λ^0 ET DES Σ^- (THÈSES). (Experimental Study of the Lepton Decays of Λ^0 and Σ^- (thesis)). Jules Six (Paris. Universite). 1962. 125p.

The lepton decays of Λ^0 and Σ^- were studied in a heavy liquid bubble chamber. The basic experimental techniques, taking the photographs, scanning the photographs, and measurement of events, are briefly described. The branching ratio of Λ^0_β was determined according to rigid criteria which included direct identification of Λ^0_β, determination of proportion of Λ^0_β separable from other Λ^0_β, and determination of the total number of Λ^0. There were 2000 events of $\Lambda^0 \rightarrow p + \pi^-$, 8 of $\Lambda^0 \rightarrow p + e^- + \bar{\nu}$, no $\Lambda^0 \rightarrow p + \mu^- + \bar{\nu}$, 250 events of $\Sigma^- \rightarrow n + \pi^-$, and no $\Sigma^- \rightarrow n + e^- + \bar{\nu}$ or $\Sigma^- \rightarrow n + \mu^- + \bar{\nu}$. The Λ^0_β and Σ_β were detected by direct visual identification of the electrons. The method used, applicable to scanning, gave an identification probability of 85% for Λ^0_β. The identification of Λ^0_μ or Σ^-_μ was based on the μ^- stopping and decaying into electrons in the liquid. The branching ratio for Λ^0_β was measured experimentally as $\rho = 0.30^{+0.15}_{-0.12}\%$. The theoretical implications of the experimental results are discussed with respect to weak interactions with and without strange particles. (J.S.R.)

16765 MECHANICAL GENERATION OF ČERENKOV RADIATION IN A PERFECT ELASTIC CONDUCTOR ADJACENT TO A VACUUM AND CONTAINED IN A MAGNETIC FIELD OF ISOTROPIC ACTION. S. Kaliski (Inst. of Fundamental Technical Problems, Polish Academy of Sciences). Bull. Acad. Polon. Sci., Ser. Sci., Tech., 11: 389-98(1963).

A solution is given of the problem of generation of Cherenkov magnetoelastic radiation from a mechanical impulse moving on the boundary of a semi-infinite elastic conductor in a magnetic field of isotropic action. The solution, obtained for the plane problem, is based on the method of characteristics, the dispersion of material constants not being considered. Potentials analogous to those of the theory of elasticity of an isotropic body are introduced, which reduce the problem to that of wave equations. (R.E.U.)

16766 MECHANICAL GENERATION OF ČERENKOV RADIATION IN A PERFECT ELASTIC CONDUCTOR ADJACENT TO A VACUUM AND CONTAINED IN A MAGNETIC FIELD OF ANISOTROPIC ACTION. S. Kaliski (Inst. of Fundamental Technical Problems, Polish Academy of Sciences). Bull. Acad. Polon. Sci., Ser. Sci., Tech., 11: 399-410(1963).

A solution is given of the problem of generation of Cherenkov magnetoelastic radiation from a mechanical impulse moving on the boundary of a semi-infinite elastic conductor in a magnetic field of anisotropic action. The solution, obtained for the plane problem, is based on the method of characteristics, the dispersion constants not being considered. (R.E.U.)

16767 MECHANICAL GENERATION OF ČERENKOV RADIATION IN CONTACTING, PERFECTLY CONDUCTING ELASTIC SOLID AND LIQUID IN MAGNETIC FIELD OF ISOTROPIC ACTION. S. Kaliski (Inst. of Fundamental Technical Problems, Polish Academy of Sciences). Bull. Acad. Polon. Scil, Ser. Sci., Tech., 11: 429-36(1963).

Solutions to the problem of generation of Cherenkov radiation in a perfectly conducting liquid and a perfect elastic conductor filling up two adjacent semispaces are presented for isotropic action of the magnetic field. The fundamental equations of motion and boundary conditions are developed. Solutions were obtained for cases of supermagnetosonic impulse velocity in both media, transmagnetosonic impulse velocity in the solid and supermagnetosonic velocity in the liquid, and submagnetosonic velocity in the solid and supermagnetosonic velocity in the liquid. (L.B.S.)

16768 MECHANICAL GENERATION OF ČERENKOV RADIATION IN CONTACTING, PERFECTLY CONDUCTING ELASTIC SOLID AND LIQUID IN MAGNETIC FIELD OF ANISOTROPIC ACTION. S. Kaliski (Inst. of Fundamental Technical Problems, Polish Academy of Sciences). Bull. Acad. Polon. Sci., Ser. Sci., Tech., 11: 437-48(1963).

Solutions to the problem of generation of Cherenkov radiation in a perfectly conducting liquid and a perfect elastic conductor filling two adjacent semispaces are presented for anisotropic action of the magnetic field. The fundamental equations of motion and boundary conditions are developed. Solutions were obtained for the cases of supermagnetosonic impulse velocity in both media, transmagnetosonic velocity in the solid and supermagnetosonic velocity in the liquid, and submagnetosonic velocity in the solid and supermagnetosonic velocity in the liquid. (L.B.S.)

16769 RELATIVISTIC PARTICLE DYNAMICS AND THE S MATRIX. R. Fong and J. Sucher (Univ. of Maryland, College Park). J. Math. Phys. (N. Y.), 5: 456-70(Apr. 1964).

Direct-interaction theories are examined from the viewpoint of relativistic scattering theory and the associated concept of "asymptotic covariance." It is pointed out that with any two-particle Hamiltonian which has no bound states there can be associated a variety of representations of the Lie algebra of the inhomogeneous Lorentz group (IHLG), although the S matrix is in general not covariant. It is shown that the requirement of asymptotic covariance ensures both the covariance of the S matrix and the existence of a unique representation of the IHLG to be associated with the relativistic two-particle system. The connection between the Lie algebra, the covariant form of the S matrix, and the uniqueness of K, the generator of pure Lorentz transformations, is thereby clarified. The extension of these considerations to include bound states is made. The form of H given by Bakamjian and Thomas is shown to satisfy asymptotic covariance and, moreover, to be the most general form of interest from the viewpoint of relativistic scattering theory, thereby including as a special case a form of H suggested by Sudarshan. It is also proved that relativistic Hamiltonians of this type do not admit the usual notion of a coupling constant. (auth)

16770 RESONANCES OF STRONGLY INTERACTING PARTICLES. A. Astier (Physique Nucleaire du College, France). J. Phys. (Paris), 24: 774-83(Nov. 1963). (In French)

The mesonic and baryonic resonances and their properties are tabulated. A discussion of the theoretical basis of classifying these resonances is presented. (T.F.H.)

16771 STUDY OF THE PRODUCTION OF TWO PHOTONS IN THE COMPTON EFFECT. Guy Burdet (Inst. of Nuclear Physics, Lyon). J. Phys. (Paris), 24: 1024-6 (Nov. 1963). (In French)

Attempts to show the experimental evidence of the double Compton effect are described. These experiments

are of two sorts, namely those based on kinematical properties and those that study the differential cross section. (auth)

16772 MEASUREMENT OF THE PARAMETERS P AND D IN p-p SCATTERING AT 138 Mev. C. Caverzasio, A. Michalowicz, K. Kuroda, M. Poulet, and N. Poutcherov (Laboratoire Joliot-Curie, Orsay, France). J. Phys. (Paris), 24: 1048-51(Nov. 1963). (In French)

Polarized protons from the Orsay synchrocyclotron (E = 138 Mev; $P_1 = 0.44$) are scattered in a liquid hydrogen target in the angular range $\theta_2 = 12$ to 100° (cm) and the value of P_2 deduced from experimental asymmetries. The polarization component normal to the second scattering plane is then observed by subsequent horizontal scattering on a plastic scintillator, the left-right asymmetries giving the depolarization parameters D at four angles. Results at large angles are in agreement with the so-called YLAM solution. (auth)

16773 STABILITY OF INHOMOGENEOUS PLASMAS IN A MAGNETIC FIELD. S. K. Trehan (Univ. of Delhi). Nucl. Fusion, 3: 294(Dec. 1963).

It is shown that the presence of a steady magnetic field does not affect the macroscopic stability of electron oscillations in nonuniform plasmas with arbitrary density or temperature gradients. (R.E.U.)

16774 π^-P INTERACTIONS AT 4.0 Gev/c. I. FOUR-PRONG EVENTS. L. Bondár(Technische Hochschule, Aachen), K. Bongartz, H. Burmeister, et al. Nuovo Cimento (10), 31: 485-519(Feb. 1, 1964).

A bubble chamber investigation of π^-p interactions was carried out at a momentum of 4 Bev/c. Analysis is limited to 2128 events with four charged secondaries. Cross sections for the different reactions including A^{++}, ρ^0, and ω production are given. Reactions are discussed in the light of the one-pion-exchange model. The A^*, ρ and ω resonances are found to be produced in peripheral interactions. Possible existence of a dipion resonance at 500 Mev shows up, however no evidence for the production in four-prong events of ABC, ζ or f^0 resonances could be obtained while the production of η's proved to be greatly suppressed due to phase-space limitations. A tentative figure for a T = 2 (nonresonant) pion-pion scattering cross-section is given. C.m.s. angular distributions are characterized by a backward going nucleon and one of the pions (in most reactions a negative one) going forward, the rest of the pions being distributed more or less isotropically. With increasing multiplicity the angular distributions become more isotropic and the resonances are smeared out. This fact may be explained by an increasing importance of final-state interactions and by a less peripheral type of production mechanism. (auth)

16775 THE MESON MULTIPLICITY IN NUCLEON-NUCLEON COLLISIONS AT 3000 Gev. C. B. A. McCusker and L. S. Peak (Univ. of Sydney). Nuovo Cimento (10), 31: 525-40(Feb. 1, 1964).

The mean multiplicity of charged particles in nucleon-nucleon collisions at 2800 Bev was determined by two different methods. The two methods give results in good agreement with each other and with Wilson cloud chamber results. The weighted mean from this experiment is $\langle n_s \rangle = 10.8 \pm 0.8$. The mean energy was found by two different methods, the second of which involves a determination of the cosmic proton energy spectrum from 10^{10} to 10^{16} ev. The change in the average multiplicity in nucleon-nucleon collisions from 16 to 2800 Bev can be well approximated by a law $\langle n_s \rangle = 4.1 \log E/\log 16$ where E is the incident proton energy in Bev. (auth)

16776 PION-NUCLEON CROSS-SECTION FOR ABSORPTION AND STRANGE PARTICLE PRODUCTION AT 6.1, 11.6 AND 18.1 Gev/c. A. Lloret, A. Bezaguet, M. Bloch, D. Drijard, D. Morellet, A. Orkin-Lecourtois, A. Rousset, and J. J. Veillet (Ecole Polytechnique, Paris). Nuovo Cimento (10), 31: 541-9(Feb. 1, 1964).

A heavy-liquid bubble chamber was exposed to 6.1, 11.6, and 18.1 Bev/c π^- beams. Respectively 33,000, 10,000, and 29,000 pictures containing approximatively 4 pions per picture were taken. The liquid used was a mixture of 86% propane and 14% freon CF_3Br by volume. The density of the liquid was 0.55, g/cm^3, its radiation length 52 cm. The absorption cross section of negative pions in the heavy liquid and the cross section for strange-particle production in the reactions: π^- + (nucleon) → (K + $\bar{K}$ + nucleon) + nπ and π^- + (nucleon) → (K + hyperon) + nπ were measured. (auth)

16777 THE KHURI REPRESENTATION AND ITS USE IN STUDYING LOW-ENERGY π-N SCATTERING IN THE $J = 3/2$, $I = 3/2$ STATE. M. Der Sarkissian (Louisiana State Univ., Baton Rouge). Nuovo Cimento (10), 31: 562-8 (Feb. 1, 1964).

Given the experimental data for low-energy π-N scattering in the $(3/2, 3/2)$ state the threshold behavior of the residue function (β) is deduced for the Regge trajectory (α) on which the $(3/2, 3/2)$ resonance lies. In order to avoid a threshold infinity in the residue function a restriction must be placed on Re α evaluated at threshold. With the threshold behavior deduced for (β) a new effective-range formula is deduced for low-energy π-N scattering in the $(3/2, 3/2)$ state. The analysis is based on the Khuri-Udgaonkar method for studying low-energy scattering of strongly interacting particles and can be extended to any resonant state where competing inelastic channels can be neglected. (auth)

16778 ON A LEE MODEL WITH A FOUR-POINT COUPLING. R. B. Marr and Y. Shimamoto (Brookhaven National Lab., Upton, N. Y.). Nuovo Cimento (10), 31: 599-614(Feb. 1, 1964). (BNL-7243)

It is shown that a modified Lee model in which a four-point interaction involving the N and θ particles is appended to the original trilinear interaction, is soluble, and provides a convenient example for the discussion of CDD poles. The parameters of the model may be selected in such a way as to allow the existence of two stable particles, or one stable and one unstable particle with the quantum numbers of a V-particle. The N-θ scattering amplitude is compared with that of a Lee model with two V-particles. (auth)

16779 SINGLE-PION PRODUCTION IN π-N COLLISIONS AND REGGE POLES. M. S. K. Razmi (Imperial Coll. of Science and Tech., London). Nuovo Cimento (10), 31: 615-34(Feb. 1, 1964).

The formalism of Regge poles is applied to the process of single-pion production in π-N collisions at high energies. It is assumed that at these energies this process is dominated by Regge poles in the crossed channel, namely nucleon-antinucleon annihilation into three pions. By a slight generalization of the usual peripheral model, the asymptotic form of the cross-section are calculated. Some preliminary experimental consequences are also indicated. (auth)

16780 NONLEPTONIC DECAY OF HYPERONS. H. Sugawara (Tokyo Univ.). Nuovo Cimento (10), 31: 635-42(Feb. 1, 1964).

The nonleptonic decays of hyperons in the baryon pole approximation are considered. SU_3 symmetry is assumed

for strong interaction and the tensor character of two-baryon vertices is uniquely determined by the $|\Delta I| = 1/2$ and $\Delta S = 1$ rules. Asymmetry parameters of hyperons including Ξ^- are expressed with three weak-interaction parameters and the ratio between f and d strong couplings. Using Σ^+ data to fix these parameters it is found that $-\alpha_\Lambda = \alpha_{\Xi^-} = 0.5$ when f coupling is 72% of d coupling. It is also found that $\Sigma^+ \rightarrow n + \pi^+$ decay must proceed via p-wave so that the correct signs of α_Λ and α_{Ξ^-} are to be derived. (auth)

16781 EFFECTS OF THE ρ-MESON ON THE PION-NUCLEON INTERACTION AND NUCLEON FORM-FACTORS. L. L. J. Vick (University Coll., London). Nuovo Cimento (10), 31: 643-59(Feb. 1, 1964).

The helicity amplitudes for T = 1, J = 1, $\pi + \pi \rightarrow N + \bar{N}$ scattering are calculated. It is shown that a simple Breit-Wigner resonance formula does not give the correct contribution to low-energy S- and P-wave π-N scattering. A modified resonance formula is introduced that enables the π-N scattering data to be fitted and also fits the nucleon isovector form-factor data, provided the width of the ρ resonance is much less than previous estimates. This width, in the region of 50 Mev full-width, is compared with recent experimental data. (auth)

16782 A THEORETICAL BASIS FOR TWO NEUTRINOS. D. K. Sen (Univ. of Toronto). Nuovo Cimento (10), 31: 660-9(Feb. 1, 1964).

It is shown how an antisymmetric tensor of rank two can be split up in a covariant manner to give rise to two 2-component Weyl's equations for a neutrino. The photon may then be regarded as a combination of two such neutrinos. (auth)

16783 THE ISOTOPIC SPIN OF THE η-MESON. D. J. Prowse, P. E. Schlein, D. H. Stork, M. Taherzadeh, and H. K. Ticho (Univ. of California, Los Angeles). Nuovo Cimento (10), 31: 670-3(Feb. 1, 1964).

The isotopic spin of the meson (η) was investigated by means of the reaction $K^- + n \rightarrow \Lambda^0 + \pi^- + \pi^0 + \pi^0$ at 765 Mev/c in a deuterium bubble chamber. (C.E.S.)

16784 A SIMPLE NONLOCAL MODEL FOR HIGH-ENERGY SCATTERING. J. T. Cushing (State Univ. of Iowa, Iowa City). Nuovo Cimento (10), 31: 688-90(Feb. 1, 1964).

It is shown that many of the results found in the study of singular and complicated multichannel local potential problems as well as some of the currently indicated behaviors of high-energy scattering amplitudes follow immediately from a simple model of a nonlocal interaction. The model is constructed with nonlocal potentials, yet possesses a double-dispersion representation and a type of crossing similar to that expected for a realistic relativistic situation. (C.E.S.)

16785 ON MORAVCSIK'S PRINCIPLE OF EQUIVALENCE. I. S. Gerstein (Univ. of Pennsylvania, Philadelphia). Nuovo Cimento (10), 31: 694-6(Feb. 1, 1964).

It is shown that contrary to the conclusions of Moravcsik, SU_3 is consistent with his principle of equivalence, which is a particular statement of the general notion that in a theory of strong interactions it should not be possible to distinguish between elementary and composite particles, independent of the particle assignments. It is also suggested that the principle of equivalence is too restrictive an interpretation of the principle of indifference since it places special importance on certain particles. (C.E.S.)

16786 SCATTERING AMPLITUDES ON UNPHYSICAL SHEETS AND RESONANCE POLES. G. Rajasekaran (Clarendon Lab., Oxford). Nuovo Cimento (10), 31: 697-700(Feb. 1, 1964).

A relation between multichannel two-particle scattering amplitudes defined on any two unphysical sheets that are connected to the physical sheet along the intervals $S_{n-j} \leq S \leq S_{n-j+1}$ and $S_n \leq S \leq S_{n+1}$ where S is the energy variable and S_n is the n^{th} threshold, is derived. The scattering amplitudes on these two sheets are T^{n-j} and T^n, respectively. The relation between T^{n-1} and T^n is used to find the condition under which a resonant pole in T^n might be accompanied by a pole in T^{n-1}. (C.E.S.

16787 REAL PART OF THE PROTON-PROTON AND PROTON-ANTIPROTON FORWARD SCATTERING AMPLITUDE AT HIGH ENERGIES. P. Soeding (Physikalisches Staatsinstitut, Hamburg). Phys. Letters, 8: 285-7(Feb. 15, 1964).

The spin independent elastic amplitude in the forward direction for p-p scattering was determined from dispersion relations and was compared to the experimental values at energies between 68 and 310 Mev. (L.B.S.)

16788 A STATISTICAL INTERPRETATION OF LARGE ANGLE PROTON-PROTON ELASTIC SCATTERING. L. W. Jones (Univ. of Michigan, Ann Arbor). Phys. Letters, 8: 287-8(Feb. 15, 1964).

A statistical model used to predict the ratio of "compound-elastic" scattering to the total cross section was investigated. Experimental data on the large-angle elastic p-p scattering by Cocconi et al. were plotted together with the prediction of the statistical model for comparison. (L.B.S.)

16789 π^+-p AND p-p ELASTIC SCATTERING AT 8.5, 12.4 AND 18.4 Gev/c. D. O. Caldwell (CERN, Geneva), B. Elsner, D. Harting, et al. Phys. Letters, 8: 288-92 (Feb. 15, 1964).

An experiment on elastic scattering, using the spark chamber technique and the CERN proton synchrotron, is described. Results are given for π^--p and p-p elastic scattering at incident momenta of 8.5, 12.4, and 18.4 Bev/c, and for π^+-p at 8.5 and 12.4 Bev/c. Results of best fit analysis of the data by the least mean squares method are tabulated. (L.B.S.)

16790 EVIDENCE FOR A π-ρ INTERACTION PRODUCED IN THE π^+ p REACTION AT 3.65 Bev/c. Gerson Goldhaber, John L. Brown, Sulamith Goldhaber, John A. Kadyk, Benjamin C. Shen, and George H. Trilling (Univ. of California, Berkeley). Phys. Rev. Letters, 12: 336-40 (Mar. 23, 1964). (UCRL-11183)

The π^+-p reaction at 3.65 Bev/c leading to four charged particles in the final state was studied with the BNL hydrogen bubble chamber. The results of an analysis of the events indicate that the majority involve some resonance phenomenon, and partial cross sections for channels leading to ρ^0, f^0, and N^{*++} formations are tabulated. An anomaly in the mass distribution of the π-ρ system was observed in the analysis of the production mechanism for ρ^0. Scatter plots of the effective-mass distributions for the two particle composites in the reaction π^+-p $\rightarrow \pi^+\pi^-$ pπ^+ are shown. A Dalitz plot for the three particles, $\rho^0\,\pi^+$p, and a Chew-Low plot for $\rho^0\,\pi^+$ events are presented. (L.B.S.)

16791 EVIDENCE FOR A P_{11} PION-NUCLEON RESONANCE AT 556 Mev. L. David Roper (Univ. of California, Livermore). Phys. Rev. Letters, 12: 340-2(Mar. 23, 1964). (UCRL-7692-T)

A energy-dependent pion-nuclear phase shift was analyzed quantitatively in search for a P_{11} resonance. The solution to the parametric equation for pion-nucleon phase

shifts and absorption parameters using available data between 0 and 700 Mev is graphically represented. (L.B.S.)

16792 DETERMINATION OF THE SPIN OF THE f^0 RESONANCE. Y. Y. Lee, B. P. Roe, Daniel Sinclair, and J. C. Vander Velde (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters, 12: 342-5(Mar. 23, 1964).

Data on π^--p interactions taken from a 3.7 Bev/c π^- exposure on the BNL hydrogen bubble chamber were analyzed to determine the spin of the f^0 resonance. Dalitz plots, cos θ distributions, and distributions of invariant mass of the di-pion systems for the $\pi^- + p \rightarrow n + \pi^+ + \pi^-$ and $\pi^- + p \rightarrow p + \pi^- + \pi^0$ reactions are presented. The results of the analysis favor a spin of L = 2. (L.B.S.)

16793 OCTET-OCTET MIXING. Peter G. O. Freund (Univ. of Chicago). Phys. Rev. Letters, 12: 348-50 (Mar. 23, 1964).

The existence of two octets of vector mesons, V, V′ in the resonance theory of form factors and the unitary symmetry scheme of strong interactions is investigated. It is shown that the inclusion of V–V′ mixing leads to good values for the coupling strengths of vector mesons to pairs of pseudoscalar mesons as well as to an explanation of the absence of the kπ modes for the proposed $K^{*1}(990)$. The results for partial widths for vector-meson decay into two pseudoscalar mesons are tabulated. (L.B.S.)

16794 USE OF $(CH_2)n$ THIN FILMS AS SYNCHROCYCLOTRON TARGETS IN STUDYING ELASTIC p-p SCATTERING. V. A. Nikitin, A. A. Nomofilov, V. A. Svirdirov, L. N. Strunov, and M. G. Shafranova (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekhn. Eksperim., No. 6, 18-22(Nov.-Dec. 1963). (In Russian)

A method is proposed for investigating elastic p-p scattering in the Bev energy range. Photoemulsions are used for detecting protons from $(CH_2)n$ films of 2μ thickness exposed to the internal beam of an accelerator. Several experimental results are given to illustrate the method. (tr-auth)

16795 PROBLEMS IN MODERN THEORY OF ELEMENTARY PARTICLES. No. 2. Papers of the All-Union Intercollegian Conference on the Quantum Theory and the Theory of Elementary Particles, Oct. 2-6, 1958. Yu. Lomsadze, ed. Problemy Sovrem. Teorii Element. Chastits, Uzhgorod. Gosudars. Univ., No. 2, 1-222(1959). (In Russian)

Twenty-eight papers are included on problems in quantum theory and the theory of elementary particles. The papers deal with spinor non-linear field theory, particle production, fusion theory, application of Schwinger variation in pair theory, generalization of Lorentz groups, space-time inversion and the Pauli transformation, particle parities, possible variants in β decay theory, fundamental law of symmetry, polarization of nucleons, nucleon interstructure, nucleon-nucleon, nucleon-pion, and nucleon-hypernuclei interactions, semiphenomenological theory of nuclear forces, influence of form factors on radiation and pair production, and perturbation methods. (R.V.J.)

16796 THE ISOTROPIC SCATTERING OF A CONCENTRATED RAY PENCIL FROM A POINT SOURCE. M. G. Smith (Sir John Cass Coll., London). Proc. Cambridge Phil. Soc., 60: 105-14(Jan. 1964).

The two-sided Laplace transform is used to obtain a solution of a certain integral equation. The equation is that associated with the transport equation for isotropic scattering, when there is a point source of radiation giving a concentrated ray pencil, in a spherically symmetric homogeneous medium extending to infinity. The solution is then used to find the asymptotic form of the intensity in the forward and backward directions. (auth)

16797 A GENERALIZATION OF THE EQUATIONS OF THE ELECTROMAGNETIC FIELD OF A MOVING ELECTRON. O. Hellman (Univ. of Turku, Finland). Proc. Phys. Soc. (London), 83: 391-5(Mar. 1964).

The covariant equations of the electromagnetic field caused by an electron moving at a constant velocity on a world line are replaced by linear and covariant functional equations. The solution of the equations, calculated in the rest system of the electron, is finite everywhere yielding a finite energy for the field of the electron. The generalized equations contain a new constant, a length l_0, so that in the limit $l_0 \rightarrow 0$ the generalized equations reduce to the corresponding classical equations. It is shown that $l_0 \propto 10^{-13}$ cm. (auth)

16798 ON THE AMBIGUITY IN THE PARTIAL WAVE ANALYSIS OF PHOTO-PION PRODUCTION PROCESS. Nien-ning Huang. Sci. Sinica (Peking), 13: 217-20(Feb. 1964).

In the partial wave analysis of the pion photoproduction process, it is found that besides the known transformation discovered by Minami there are two other kinds of transformation which also leave the angular distribution of photopions invariant. One of these new transformations may be interpreted as the simultaneous rotation of the nucleon spin around the relative momentum in the initial system and that in the final system. The other is the product of the former with the old one. Therefore, it may be interpreted as the simultaneous rotation of the nucleon spin and the photon spin around the relative momentum in the initial system. As it affects nothing in the final system, the knowledge of phase shifts of pion–nucleon scattering does not help to remove this degeneracy in the partial wave analysis of the photopion production process; it then has significance from the practical point of view. The effect of these transformations to other observable quantities is also discussed. (auth)

16799 SOME EMPIRICAL FORMULAS FOR MASSES OF π-π RESONANCES. Chong-shou Gao (Peking Univ.). Sci. Sinica (Peking), 13: 336-7(Feb. 1964).

Empirical formulas for masses of the π-π resonances are presented. A new quantum number is introduced to distinguish various states. The quantum number appears in the mass formulas just as the angular momentum appears in the energy of a rotator. (C.E.S.)

Field Theory and Quantum Mechanics

Refer also to abstract 16046.

16800 PERTURBATION THEORY FOR SYSTEM OF MANY-FERMIONS STARTING FROM DEGENERATE STATE. Z. Pluhar and I. Ûlehla (Czech. Tech. Univ., Prague). Czech. J. Phys., 13: 861-70(1963).

Expressions are found for the vector of the normal state of a many-fermion system if the unperturbed system is degenerate. The problem is solved by means of the perturbation expansion of the resolvent operator. The method can be used to calculate the coupling energy and wave functions of the electrons and even of the nucleons in incompletely occupied shells. (auth)

16801 SECOND-ORDER PERTURBATION THEORY IN ATOMIC AND MOLECULAR QUANTUM MECHANICS (APPLICATION TO THE ELECTRIC DIPOLE AND QUADRU-

POLE POLARIZABILITIES AND SHIELDING FACTORS OF THE BERYLLIUM ATOM). Hugh P. Kelly (Univ. of California, San Diego, La Jolla, Calif.) and Howard S. Taylor. J. Chem. Phys., 40: 1478-85(Mar. 15, 1964).

A new method, previously used in calculating atomic correlation energies, is shown to be applicable to a wide variety of atomic and molecular problems. Use is made of the fact that it is possible in many problems to calculate exactly the first-order perturbation correction to uncoupled Hartree-Fock wavefunctions and also second-order energy expressions. Particular application is made to the numerical calculation of dipole and quadrupole polarizabilities and shielding factors for the beryllium atom. (auth)

16802 REMARKS CONCERNING RECIPROCITY IN QUANTUM MECHANICS. D. E. Bilhorn (Case Inst. of Tech., Cleveland), L. L. Foldy, R. M. Thaler, W. Tobocman, and V. A. Madsen. J. Math. Phys. (N. Y.), 5: 435-41 (Apr. 1964).

A new derivation of the reciprocity theorem is given. The general invariance property of the hamiltonian which leads to symmetry of the Green's function for a quantum mechanical system is exhibited. It is found that reciprocity does not necessarily imply Hermiticity of the hamiltonian, so that the "complex optical model potential," for example, satisfies the reciprocity relations. The concept of reciprocity is then generalized to include a somewhat wider class of symmetry properties. Some properties of antiunitary transformations are discussed. (auth)

16803 MULTIPLICATIVE SYMMETRIES IN AXIOMATIC QUANTUM FIELD THEORY. Eduard Prugovečki (Princeton Univ., N. J.). J. Math. Phys. (N. Y.), 5: 442-55(Apr. 1964).

The group of all multiplicative symmetries defined for a finite number of interacting fields is studied in detail. Various theorems are proved connecting the existence of multiplicative symmetries with properties of the Wightman distributions of the fields. (auth)

16804 FIELD OPERATORS FOR BOSONS WITH IMPENETRABLE CORES. II. EQUATIONS OF MOTION AND GENERAL OPERATOR FORMALISM. Ko Aizu (Rikkyo Univ., Tokyo), Gianfausto Dell'Antonio, and Arnold J. F. Siegert. J. Math. Phys. (N. Y.), 5: 471-89(Apr. 1964).

Continuing the investigation started in Part I, equations of motion in the Fock representation and a nonrelativistic field theory for bosons interacting as hard spheres are developed. (auth)

16805 CAUSALITY IMPLIES THE LORENTZ GROUP. E. C. Zeeman (Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France). J. Math. Phys. (N. Y.), 5: 490-3(Apr. 1964).

Causality is represented by a partial ordering on Minkowski space, and the group of all automorphisms that preserve this partial ordering is shown to be generated by the inhomogeneous Lorentz group and dilatations: (auth)

16806 NEW METHODS FOR REDUCTION OF GROUP REPRESENTATIONS USING AN EXTENSION OF SCHUR'S LEMMA. John Gabriel (Argonne National Lab., Ill.). J. Math. Phys. (N. Y.), 5: 494-504(Apr. 1964).

The generators of the group or group algebra are used in an analogue of the Lie–Cartan method, which can be applied to finite or infinite groups. This gives a mean for reduction of an arbitrary group representation, using only the matrix representatives of the generators. It is a set of algorithms using pivotal condensation and can easily be coded as a digital computer program. Connections with Lie–Cartan Theory are suggested, the reduction of the symmetric group discussed, and methods for the reduction of representations of the n × n unitary, orthogonal, and proper orthogonal groups suggested. (auth)

16807 ELASTIC, ELECTROMAGNETIC, AND OTHER WAVES IN A RANDOM MEDIUM. Frank C. Karal, Jr. and Joseph B. Keller (New York Univ., New York). J. Math. Phys. (N. Y.), 5: 537-47(Apr. 1964).

Propagation of any type of wave in a random medium is analyzed on the assumption that the medium differs slightly from a homogeneous medium. An equation satisfied by the average wave is deduced which is correct through terms of order ϵ^2, where ϵ measures the deviation of the medium from homogeneity. From this equation, the propagation constant of the medium is determined. The general formulation applies to any type of linear differential or integral equation with random coefficients. It is applied to time-harmonic waves satisfying the reduced wave equation, to the equations of elasticity and to Maxwell's equations. The propagation constant for the average or coherent wave is complex even for a nondissipative medium, because the coherent wave is continually scattered by the inhomogeneities and converted into the incoherent wave. The propagation velocity of the average wave is also diminished by the inhomogeneities. This propagation constant depends upon certain trigonometric integrals of the auto- and cross-correlation functions of the coefficients in the original equations, i.e., of the various coefficients characterizing the medium. To illustrate the results, media with particular random variations are considered and the propagation constants are determined for them. (auth)

16808 ANALYTIC REGULARIZATION AND THE DIVERGENCES OF QUANTUM FIELD THEORIES. C. G. Bollini (Facultad de Ciencias Exactas, Buenos Aires), J. J. Giambiagi, and A. Gonzáles Domínguez. Nuovo Cimento (10), 31: 550-61(Feb. 1, 1964).

A method of analytic regularization with which any element of the S-matrix becomes an analytic function of a complex parameter is presented. The usual divergences appear simply as poles at the physical value of the parameter. The subtraction of these poles leads to the usual finite parts. A simple example is discussed, in which the mathematical justification for these subtractions is given. In the consideration of this example the causal Green functions of the iterated D'Alembertian is discussed. They are constructed from the retarded and advanced solutions introduced by M. Riesz. The application to the self-energy of the electron is explicitly given. An heuristic deduction is then used to convert the problem of the evaluation of the self-energy into the problem of solving a differential equation. The self-energy integral is a formal solution of the latter equation, the finite part (with the pole subtracted) being a rigorous solution. (auth)

16809 ON THE EQUILIBRIUM PROPERTIES OF A TWO-DIMENSIONAL SYSTEM OF PARTICLES WITH A REPULSIVE RADIAL INTERACTION. R. J. Baxter (Australian National Univ., Canberra). Phys. Letters, 8: 255-7(Feb. 15, 1964).

The analogy between the equilibrium properties of a classical two-dimensional system of particles with a repulsive radial interaction potential and a one-dimensional quantum mechanical system with only nearest neighbor interaction is presented. (L.B.S.)

16810 GROUND-STATE OCCUPANCY OF AN IDEAL BOSE-EINSTEIN GAS CONFINED TO A FINITE VOLUME. D. L. Mills (Univ. of California, Berkeley). Phys. Rev., 134: A306-8(Apr. 20, 1964).

The number of particles in the ground state has been computed as a function of temperature for an ideal Bose-Einstein gas confined to a box of finite volume by evaluating the discrete sum over states on a computer. Large deviations from London's bulk-gas result are found when the length of the box is much greater than its width for the range of dimensions investigated here. It is shown that the deviations occur because in this limit the system tends to behave like a one-dimensional system. (auth)

16811 SIMPLIFIED APPROACH TO THE GROUND-STATE ENERGY OF AN IMPERFECT BOSE GAS. III. APPLICATION TO THE ONE-DIMENSIONAL MODEL. Elliott H. Lieb (Yeshiva Univ., New York) and Werner Liniger. Phys. Rev., 134: A312-15(Apr. 20, 1964).

The study of the integrodifferential equation proposed previously for the evaluation of the ground-state energy of an imperfect Bose gas is continued. It is applied to the one-dimensional delta-function gas where the exact result is known for all values of the coupling constant γ. The results are: (i) For small γ, the equation given the correct first two terms in an asymptotic series; (ii) a numerical solution of the equation shows that the maximum relative error occurs for $\gamma = \infty$ in which case it is 19%; (iii) for $\gamma = \infty$ the exact two-particle distribution function is compared with that given by the equation. The agreement is quite good. (auth)

16812 QUESTION OF SIZE CORRECTIONS TO THE STEADY DIAMAGNETIC SUSCEPTIBILITY OF SMALL SYSTEMS. Lionel Friedman (Univ. of Pittsburgh). Phys. Rev., 134: A336-44(Apr. 20, 1964).

The order of magnitude of the (orbital) diamagnetic susceptibility of a free electron gas is investigated for the case of "small" systems. A small system is, by definition, one whose characteristic linear dimensions are very much less than the radii of the average classical electronic orbits in an applied dc magnetic field. For the case of plane-slab geometry, exactly the Landau susceptibility (i.e., no size effect) is obtained for Maxwell-Boltzmann statistics. Furthermore, on the basis of the latter calculation, it is explicitly demonstrated that the use of the WKB approximation leads to a spurious size effect, suggesting that this (or equivalent) approximations may be responsible for size corrections found by other authors. For the degenerate case, the Landau result is also obtained, to within a numerical factor. Finally, no size correction is obtained in the small size limit for an electron gas confined by a harmonic potential well; this further suggests that the Landau result is independent of the choice of boundary potential. (auth)

16813 APPROXIMATE SOLUTION TO THE N/D EQUATIONS. Gordon L. Shaw (Stanford Univ., Calif.). Phys. Rev. Letters, 12: 345-8(Mar. 23, 1964).

An approximate solution to the N/D equations which does not have the limitations of the determinantal method developed by Baker and yields a closer approximation to the actual solution for some cases is presented. The result of a numerical example is given. The advantages of both methods are discussed. (L.B.S.)

16814 ON THE HARTREE-FOCK SOLUTION IN FIELD THEORY. Yasushi Takahashi and Hiroomi Umezawa (Tokyo Univ.). Physica, 30: 49-58(Jan. 1964).

It is pointed out that the inequivalent representation inherent in quantum field theory plays an essential role in the many-body problem. From this point of view is discussed the Bardeen model of superconductors and the Hartree solution is obtained as a rigorous one. (auth)

16815 THE PARTITION OF ENERGY IN COSMICAL PHYSICS. B. O. J. Tupper (Univ. of Exeter, Eng.). Proc. Cambridge Phil. Soc., 60: 93-5(Jan. 1964).

Eddington's energy partition in cosmic physics is discussed and the partition equations are found to have a very simple form. It is shown that the rigid-field convention leads to a triviality. (auth)

16816 ON SPACE-TIMES WITH BOUNDED EMPTY REGIONS. L. Marder (Southampton Univ., Eng.). Proc. Cambridge Phil. Soc., 60: 97-103(Jan. 1964).

If two empty regions of space-time are entirely separated by matter, little information of the nature of one region can be gained by knowledge of the other. Examples of a hollow Schwarzschild sphere and a hollow static torus are considered. In the first of these, it is shown that the size of the flat interior is not at all limited by the smallness of the Schwarzschild mass constant, the other spherical boundary, or the condition that the sphere be constructed only of matter of positive density with positive stress-energy scalar. (auth)

16817 KINETIC EQUATIONS AND MULTI-TIME-SCALE FORMALISM IN WEAK COUPLING THEORY. D. Frank, D. Pfirsch, and S. Priess (Max-Planck-Institut für Physik und Astrophysik, Munich). p.183-4 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Some results of the multi-time-scale formalism for the weak-coupling case are discussed. Sandri found a condition that a kinetic behavior is only established if there are not too many particles moving with the same velocity. It is shown that this condition is a consequence of the weak-coupling formalism only, but it is not necessary to reach a kinetic regime. It is further proved that the kinetic equation in the next slower time scale is not compatible with the Landau equation. (auth)

16818 FORMULATION OF THE FOKKER-PLANCK EQUATION INCLUDING EXCITATION EFFECTS. W. A. Janos (Raytheon Co., Waltham, Mass.). p.253-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

An analysis is outlined concerning the solutions of a class of Fokker-Planck kinetic equations describing the Brownian motion of a negligibly self-interacting electron gas in the presence of distributed atomic scatterers and time-dependent external electromagnetic fields. The form of Green's function for this general class of partial differential equations is given explicit expression in terms of the collisionless time development operator on the set of initial velocities under the influence of the external fields and viscous force. It was therefore possible to include the inelastic collision processes of excitation–deexcitation of atomic scatterer states as velocity (kinetic energy) surface boundary conditions. In order to consider such inelastic effects the velocity space was partitioned into a sequence of concentric spherical shells, the radii squared of each shell being proportional to the excitation energy of two successive atomic states. The electron distribution function is thus considered a vector, each component of which is the distribution function evaluated in a given energy shell. The fine-grained Brownian behavior was assumed to take place within each energy shell while the excitation–deexcitation phenomena were interpreted as boundary conditions, sums over all states of transition to and from a given electronic energy range. Thus the form of the kinetic equation for the electron distribution is that of a partial differential-recursion equation. Use of the Green's function solution for the free velocity space boundary then simplifies the

problem as a more directly solvable form of recursion equation. (auth)

16819 THE NONLINEAR VLASOV EQUATION, ITS MOMENT DESCRIPTION, AND THEIR CORRESPONDING LINEAR FORMS. Norman J. Zabusky (Bell Telephone Labs., Inc., Whippany, N. J.). p.281-5 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The nonlinear Vlasov equation was represented by an infinite number of coupled moment equations, $(M_{n+1})_x + (M_n)_t + (eE/m)\, n\, M_{n-p} = Q$, $n = 1, 2, \ldots$, where $M_n(x,t) = \int_{-\infty}^{+\infty} v^n f(x,v,t)\, dv$. The dispersion relation of the linearized equation was studied for various closure procedures. If it is closed by omitting the highest moment of the last equation, the dispersion relation is equivalent to the asymptotic expansion of the Vlasov dispersion relation. For large wavelengths, the plasma mode is unaffected by the closure procedure to $O(R^4)$. The additional modes are all complex if the closure parameters are small in comparison with the moments of the distribution function. A careful study was made of a sixth-degree polynomial whose coefficients were derived from an anisotropic equilibrium distribution function. The variation of the plasma modes and the additional complex modes were plotted as functions of the anisotropy parameter. (auth)

Geophysics

16820 THE AURORAL RAYS. Syun-Ichi Akasofu (Univ. of Alaska, College). J. Atmospheric Terrest. Phys., 25: 163-5(1963).

A band which appeared over College (Alaska) on the night of March 24, 1962, provided an excellent chance to examine the ray structure of the aurora. Photographs of the bottom edge of the band suggest that the auroral rays are a small-scale folding structure produced by a positive space charge within the auroral electron sheet-beam. It seems unlikely, however, that the auroral draperies are related to the same type of instability. (auth)

16821 THE LOWER LIMIT OF LATITUDE (US SECTOR) OF NORTHERN QUIET AURORAL ARCS, AND ITS RELATION TO Dst(H). S. I. Akasofu (Univ. of Alaska, College) and S. Chapman. J. Atmospheric Terrest. Phys., 25: 9-12(1963).

A study is made of the relation between the lower limit of latitude attained by quiet arcs in the U.S. sector during IGY, 16 magnetic storms, and the intensity of the magnetic field produced by the ring current. It is shown that the equatorward shift of quiet arcs is closely related to the growth of the ring current. (auth)

16822 THE EFFECT OF DISTURBANCES OF SOLAR ORIGIN ON COMMUNICATIONS. G. J. Gassmann, Ed. Oxford, Pergamon Press, 1963. 350p. £5.

Separate abstracts were prepared for 24 of the 26 papers presented; the 2 remaining papers were on radio propagation quality in the North Atlantic and the effects of the 11-year sunspot cycle on h-f communications. (R.E.U.)

For abstracts of individual papers see: 16823, 16824, 16825, 16826, 16827, 16828, 16829, 16830, 16831, 16832, 16833, 16834, 16835, 16836, 16837, 16838, 16839, 16840, 16841, 16842, 16843, 16844, 16845, and 16846.

16823 SUDDEN IONOSPHERIC DISTURBANCES. VERIFIED EFFECTS AND PROBABLE CAUSES. Pierre Halley. p.1-20 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963. (In French)

The sudden ionospheric disturbances (SIDs) are the geophysical result of certain solar chromospheric eruptions. The most serious effect to radio communications consists of an abnormal absorption of middle and short waves in the lower ionosphere. The fade out time of these waves may last from several minutes to several hours. The h-f circuits are attenuated in the entire sunlit hemisphere, and sometimes also the vhf forward scatter circuits. The propagation of long waves below about 300 kc is improved, especially in the 10 to 50 kc range. The abnormal ionization in the D- and lower E-region is due mainly to soft x rays, emitted during the flares as bremsstrahlung from fast electrons in the chromosphere. The height profile of the additional ionization, below and above 85 km, depends on the energy spectrum of the ionizing radiation, which varies from flare to flare. It follows from the study of ionospheric absorption that the ionization extends from below the 60 km level up to the E-layer maximum. The increase of cosmic radiation, exceptionally associated with certain very strong flares, can cause abnormal absorption of prolonged duration. This kind of perturbation involves also the dark hemisphere. The SIDs are frequent only at the maximum of the sunspot cycle. (auth)

16824 THE OCCURRENCE OF POLAR CAP ABSORPTION. D. K. Bailey (National Bureau of Standards, Boulder, Colo.) and J. M. Harrington. p.21-4 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Preliminary statistics of the occurrence of PCA events from 1952 to 1960 are presented based on the field strength recordings of ionospheric forward scatter links. A total of 21 PCAs of medium and larger intensity were discovered. The correlation of the size of PCAs to the intensity of cosmic ray bursts as observed simultaneously on ground is poor. (auth)

16825 INFLUENCE OF SOLAR PARTICLE RADIATIONS ON ARCTIC HF PROPAGATION. Leif Owren (Univ. of Alaska, College). p.25-36 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

The response of transarctic and transauroral h-f circuits to solar particle impacts is discussed. The experimental results are based on continuous 12 and 18 Mc pulse transmissions from College, Alaska, over a 5200-km arctic path to Kiruna, Sweden, over a 5300-km auroral zone path to Boston, Massachusetts, and over a 3500-km subauroral path to Stanford, California, together with measurements of ionospheric absorption from a chain of riometers. The auroral zone and subauroral circuits responded in the expected manner to the solar particle induced disturbances. The 12 Mc transarctic circuit was expectedly found to be sensitive to polar cap absorption caused by high energy solar particles. It was insensitive to a severe magnetic storm event associated with widespread, heavy auroral zone absorption causing prolonged radio blackouts on other circuits. Contrary, the 18 Mc transarctic circuit was found to be very sensitive to the magnetic and auroral activity but not to the polar cap absorption. This behavior together with best signal reception during the winter months suggests 18 Mc transarctic propagation by lateral deviation in the auroral zone. Regular 18 Mc multipath reception at Kiruna during the winter indicates further unconventional mode possibilities. (auth)

16826 IONOSPHERIC POLAR BLACKOUTS AND RADIO COMMUNICATION DISTURBANCES. Tatsuzo

Obayashi (Arctic Inst. of North America, Washington, D. C.). p.37-45 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

In the polar region radiowaves suffer very intense absorption occasionally and they are then known as "polar blackouts." It is found that the polar blackout has two different origins; one is produced by low energy solar cosmic rays ejected from an intense solar flare and the other is produced by auroral particles. The former is called the polar cap blackout because it is confined to the entire polar region, while the latter occurs mainly along the auroral zone. Some morphological studies of these polar blackouts are reviewed and general characteristics of the world-wide development of disturbances are discussed in connection with radio communication problems. (auth)

16827 THULE TO COLLEGE 12 Mc PROPAGATION DURING THE APRIL AND MAY 1960 INTENSE POLAR CAP ABSORPTION EVENTS. R. D. Egan (Stanford Univ., Calif.). p.47-58 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

During a seven-month period, continuous signal-strength measurements of pulse signals from Thule, Greenland, were made at College, Alaska. A number of significant polar cap absorption events (type III) were recorded during April and May, 1960, on riometer equipment. The spread of the polar cap absorption southward may be traced in successive drops of the 12 Mc signal strength on the Thule–College path. During these polar cap absorption events, cosmic noise absorption may exceed 10 db at 27 Mc at Thule and College. However, 12 Mc signals propagated from Thule were received continuously at College with only 35 db attentuation during the peak of the absorption. These observations indicate that the attenuation does not obey an inverse frequency-squared law (as would be expected in regions where the electron neutral-molecule collision frequency is on the order of 10^7 sec^{-1}) and also indicate that the attenuation reaches a surprisingly low maximum value shortly after the beginning of a polar cap absorption event. After reaching this maximum value, the absorption remains essentially constant throughout the event. (auth)

16828 A NOTE ON HF COMMUNICATIONS DURING POLAR RADIO BLACKOUTS. K. Folkestad and B. Landmark (Norwegian Defence Research Establishment, Kjeller, Norway). p.59-64 of "The Effects of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Preliminary results are presented from a study of h-f transpolar propagation conditions. Transmissions from College, Alaska, on 12 and 18 Mc received at Kjeller, Norway, were analyzed. Distinction was made between days that are either disturbed or rather quiet, and the selection was based on results from riometer observations. The possibility of reducing the importance of the polar disturbances by means of technique is also discussed. (auth)

16829 THE INFLUENCE OF POLAR BLACKOUTS ON VLF CIRCUITS. B. Landmark (Norwegian Defence Research Establishment, Kjeller, Norway). p.65-77 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Results from a study of the behavior of long distance vlf circuits during polar radio blackout conditions, as compared with quiet conditions are presented. There are at least two major types of polar radio blackouts. The most common type, which is normally referred to as the auroral type, is closely related to magnetic disturbances, and occurs most often near the zones of maximum auroral activity. The results of our study indicate that these disturbances have no great effect on the vlf circuits. The other type of polar blackouts, which is normally referred to as polar cap type events or proton events, is not closely related to magnetic activity, and occurs over most of the polar cap simultaneously. During this type of events a significant reduction of the strength of the vlf signals was observed. (auth)

16830 THE INFLUENCE OF SOLAR DISTURBANCES ON VERY LOW FREQUENCY RADIO WAVE PROPAGATION OVER A LONG HIGH-LATITUDE PATH. Alv Egeland, Bengt Hultqvist, and Johannes Ortner (Kiruna Geophysical Observatory, Sweden). p.79-100 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

The effects of solar and terrestrial disturbances on the propagation conditions on 16 kc radio waves between Rugby, England, and Kiruna, Sweden, a distance of about 2100 km, are discussed. (auth)

16831 INFLUENCE OF SOLAR FLARES ON TRANS-ARCTIC HF PROPAGATION. Johannes Ortner (Kiruna Geophysical Observatory, Sweden). p.101-7 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

From the observed effects of solar flares on the transpolar h-f transmissions between College, Alaska, and Kiruna, Sweden, the following conclusions were reached: (1) SIDs were only observed in summer accompanying important 3 and 3+ solar flares. (2) Flares emitting solar protons with relativistic velocities were followed by absorption starting a few hours after the flares and lasting for several days. (3) The correlation of absorption with geomagnetic activity as observed for Kiruna seems to be fairly good for the 18 Mc receptions. (auth)

16832 COMPARISON OF SOLAR FLARE EFFECTS IN THE D AND E REGION OF THE IONOSPHERE. K. Bibl. p.109-18 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

It is shown that the different enhancement of ionization in the ionospheric D- and E-regions is due to different kinds of solar radiation. An attempt is presented to find a one-dimensional parameter indicative of the energy distribution on the solar spectrum that is independent of strength and daytime of the event. With the help of the new technique of continuously recorded ionospheric parameters and of an automatic warning system, every ionospheric event can be detected and misinterpretations can be avoided. Only very narrow solar latitude spheres are responsible for the ionospheric effectiveness of flares. (auth)

16833 A STUDY OF F2 LAYER EFFECTS AS OBSERVED WITH A DOPPLER TECHNIQUE. K. Davies, J. M. Watts, and D. H. Zacharisen (Central Radio Propagation Lab., Boulder, Colo.). p.119-33 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Changes in the height and shape of the ionosphere produce variations in the frequency, at a receiver, of waves emitted from a stable sender. Standard frequency transmissions from WWV were recorded on slow-moving magnetic tape. By rapid playback the Doppler frequency is converted into an audio frequency and the spectrum analyzed by conventional techniques. Records obtained by this technique are

presented to illustrate the phenomena observed during magnetically quiet and disturbed periods. Experimental effects associated with solar flares and magnetic sudden commencements are presented. The frequency dependence of the frequency variations is shown to give information concerning the height location of the associated ionospheric effects. (auth)

16834 STUDY OF THE EFFECT OF TYPE IV SOLAR ERUPTIONS ON THE WORLDWIDE IONOSPHERIC ABSORPTION. D. Lepechinsky and C. Davoust (C.N.E.T., Bagneux, France). p.135-42 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963. (In French)

The effects of solar flares on region D of the ionosphere, where certain types of flares produce a sudden increase of ionization and of radiowave absorption (SIDs), were examined. In contrast with the anomalous ionospheric absorption and blackouts occurring in polar regions and associated with corpuscular flux arrivals, proton-events, and ionospheric storms, the absorption enhancements due to the solar uv and x radiation are almost synchronous with the corresponding solar flares and are relatively short lived, lasting only about 1 hr. (auth)

16835 BACKSCATTER SOUNDING DURING IONOSPHERIC STORMS. I. Ranzi and P. Dominici (Centro Radioelettrico Sperimentale "G. Marconi," Rome). p.143-54 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

The results of ionospheric backscatter soundings carried out during some severe ionospheric storms from August, 1957, to February 1961, are briefly discussed. The advantages of the backscatter soundings for studying the morphology of an ionospheric storm over a large area are discussed. The observed displacement of the perturbed zone is explained as the result of the superposition of the D_{st} and S_D storm components. During an ionospheric storm, the echoes from the nondisturbed zone show a stronger intensity and a wider extent than during normal conditions. (auth)

16836 THE INFLUENCE OF SUDDEN IONOSPHERIC DISTURBANCES ON BACKSCATTER SOUNDING. R. D. Egan and A. M. Peterson (Stanford Univ., Calif.). p.155-63 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Analysis of the IGY three-frequency backscatter records during sudden ionospheric disturbances (SID) is presented. It was found that the majority of the SIDs produce expected effects on the backscatter echoes. The multiple hops disappear shortly after the SID onset and are followed by the disappearance of all echoes during the period of maximum absorption. During the recovery phase of the SID there is a slow recovery of backscatter echoes back to normal. In most cases no change in the skip distance (MUF) occurs during the SID. However, in a number of cases a distinct range increase of more than 500 km in the first hop skip distance occurred. Thus, the MUF was decreased, requiring a decrease in operating frequency, contrary to the more normal procedure of increasing frequency or awaiting the end of the SID. Long-distance high-frequency propagation-circuit data and riometer records for the same events are compared with the backscatter observations. (auth)

16837 EFFECTS OF MAGNETIC DISTURBANCE AS NOTED ON OBLIQUE-INCIDENCE IONOGRAMS. V. Agy and K. Davies (National Bureau of Standards, Boulder, Colo.). p.167-76 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

From 1951 to 1958 the sweep-frequency pulse technique was used to study high-frequency radio propagation over two east-west paths—Washington to St. Louis (1150 km) and Washington to Boulder (2370 km). Some ionograms observed during magnetic disturbances are presented and compared with quiet ionograms. The behavior of the maximum and the minimum observed frequency is discussed. (auth)

16838 SOLAR EFFECTS ON RADIO WAVE PROPAGATION. M. Bossolasco and A. Elena (Universita, Genova, Italy). p.177-83 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Some results regarding the reception of WWV signals (15 Mc) at Genova are presented. The daily variation of the intensity of the signals is well controlled and represented by the MUF (4000 km) F2. For the first four months of 1961 at night-time, the correlation coefficient between the WWV-intensity and the MUF was found to be 0.87. (auth)

16839 SOLAR-INDUCED EFFECTS ON VHF IONOSPHERIC PROPAGATION AT LOW MAGNETIC LATITUDES. Walter F. Bain (Page Communications Engineers, Inc., Washington, D. C.). p.185-92 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Signal-intensity behavior on the Pacific scatter circuits was examined during periods of both moderate and severe ionospheric storminess and during relatively small magnetic fluctuations such as a magnetic bay. Although h-f circuits either failed or experienced substantial degradation during severe ionospheric disturbances, the vhf turbulent-scatter mode was virtually unaffected. However, it may be concluded that the strong field-aligned daylight component present on the equatorial circuits is rapidly and adversely affected by even small magnetic events. The remaining turbulent-scatter signal intensities on these circuits appear unaffected, as do the signals on the circuits showing turbulent scatter only. Even during extremely severe disturbances, the turbulent scatter component showed no deterioration other than momentary drops during severe short-wave fadeouts. (auth)

16840 ON THE INFLUENCE OF DISTURBANCES OF SOLAR ORIGIN ON OBLIQUE-INCIDENCE PULSE TRANSMISSION. W. Dieminger, H. G. Moeller, and G. Rose (Max-Planck-Institut fur Aeronomie, Lindau, Ger.). p.193-206 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

During the IGY, multi-frequency pulse transmissions and simultaneous backscatter observations were carried out over two paths, from Lindau, Germany, 2000 km to Finland and from Lindau 8000 km to southwest Africa. The effects of solar flares, simultaneous and delayed, are described and interpreted. (auth)

16841 THE PROBLEM OF ARCTIC COMMUNICATIONS FOLLOWING SOLAR DISTURBANCES. S. C. Coroniti, G. E. Hill, and R. Penndorf (AVCO Corp., Wilmington, Mass.). p.207-22 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

The blackout of polar h-f radio-frequency communications during intense magnetic storms is presently accepted without question. It is tacitly assumed that all links of a polar communication network are affected simultaneously. Analysis of polar ionosonde data for 5 solar-induced iono-

spheric storms shows clearly that this assumption is erroneous. It was found that during the history of the storms, the reflecting and the absorbing ionospheric layers vary in a fixed, predictable, and complex pattern. This spatial and time behavior of the ionospheric layers was used to design hypothetical h-f polar communication links that are reliable during "quiet" and "disturbed" periods of the ionosphere. It was found that by the use of a frequency and link switching technique (FLS), communication to the middle latitudes and within the polar area was indeed theoretically possible even during an intense polar cap blackout. The analysis showed surprisingly little difference between the usable frequency spectrum necessary for network operation during quiet and storm conditions. This FLS technique is then discussed from an operational point of view for this network. (auth)

16842 RELATION OF SOLAR ACTIVE REGIONS AT CENTRAL MERIDIAN PASSAGE TO IONOSPHERIC DISTURBANCE. C. S. Warwick and J. V. Lincoln (National Bureau of Standards, Boulder, Colo.). p.229-44 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

The differences in solar-terrestrial relations during years of high solar activity and during years of low solar activity are described. Clear relations between individual solar events and geomagnetic disturbances are found at times of high activity, whereas only relatively weak relations are present at times of low activity. However, in the low activity years, 27-day recurrence patterns are established. The radio propagation effects accompanying geomagnetic disturbances at the different times of the cycle are discussed. (auth)

16843 ON THE 27 DAYS RECURRENCE TENDENCY OF RADIO PROPAGATION DISTURBANCES IN THE PERIOD OF HIGH SOLAR ACTIVITY. A. Ochs and B. Beckmann (Fernmeldetechnisches Zentralamt, Darmstadt, Ger.). p.235-44 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

A report is given on some statistical investigations dealing with the radio propagation quality figures determined for the North Atlantic path. The quality figures show the recurrence tendency. During high activity the recurrence is, however, less pronounced and more irregular than during the period of low solar activity, in the course of the sunspot cycle. When used in addition to the evaluation of the various other solar and geophysical phenomena, it gives valuable assistance in forecasting propagation disturbances, even during the sunspot maximum. A description of the method used for evaluating the quality figures is given. (auth)

16844 CLASSIFICATION OF IONOSPHERIC STORM TYPES (AND TYPE-DEPENDENCE ON SOLAR-GEOMAGNETIC PHENOMENA). R. J. Cormier (Air Force Cambridge Research Center, Bedford, Mass.). p.245-59 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Ionospheric storms are classified into various types dependent on the amount of shrinkage or expansion of the useful h-f frequency spectrum, for the days of the storm period. A total of 15 storms was analyzed. Two major types; positive, showing contracted useful spectrum, and negative, showing expanded useful spectrum, as well as 3 minor types, are shown. The type of storm seems dependent on the percentage change, rather than the absolute magnitude, of the magnetic activity. The negative storm (type C) is dependent on the duration, rather than the magnitude, of the magnetic storm, while the positive storm (type A) shows a correlation with both duration and magnitude of the magnetic storm. (auth)

16845 A YEAR'S STUDY OF THE INDEX OF IONOSPHERIC STORMINESS. H. S. Marsh, R. J. Cormier, R. A. Swirbalus, W. H. Cameron, and R. S. Murphy (Air Force Cambridge Research Center, Bedford, Mass.). p.261-301 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

Hours-in per day and other attributes were recorded and studied on selected WWV and CHU frequencies. By comparison of disturbed days with monthly quiet day averages, indices of storminess-contraction of the useful path spectrum, of MUF and LUF deviations, and MUF/LUF index showing whether spectrum damage is mainly due to MUF or LUF deviation, are found, These indices for each day are compared with Fort Belvoir f_0F2 and Fredrickburg A_k variations, and strong correlation found. Correlation with NARWS quality figures is also close, for Storm Index values above 10 or 15 per cent. Monthly and seasonal trends of A_k and Storm Index intensities are established and discussed. An empiric law relating A_k intensity to same-day Storm Index, or spectrum-damage, is established. It takes the form of an hyperbolic spiral. Considering the magnetic disturbance as a shock-pulse, and consequent Storm Index variations as a resultant damped oscillation lasting for several days, the rate of magnetic disturbance growth and decay is shown to be related clearly with one of several typical forms of Storm Index morphology. The vast magnetic and ionospheric disturbances beginning at the ends of March and April 1960 are examined in detail. Four-hour variations of signal intensities, useful spectrum-widths, Storm Index, and MUF/LUF index, and rotation occurrences, are compared with variations of E- and F-MUF, E_s, and Spread-F occurrences, based on Fort Belvoir and Fort Monmouth (approximate mid-path) readings. Study is made of the "Concord Anomalies," an occurrence pattern of apparent Faraday rotations and allied two-tone frequency selectivity caused by a special form of frequency diversity around the disturbed periods, to determine their causation and permissive agencies and the practicability of their use in advance-disturbance prediction. An SID with no accompanying flare is also reported. (auth)

16846 ON THE EFFECT OF SOLAR DISTURBANCES ON THE LOW-RADIO-FREQUENCY IONOSPHERE REFLECTION PROCESS. J. R. Johler and J. D. Harper, Jr. (National Bureau of Standards, Boulder, Colo.). p.303-34 of "The Effect of Disturbances of Solar Origin on Communications." Oxford, Pergamon Press, 1963.

A flexible theoretical model plasma, which can be deformed to fit most any measured electron-ion altitude profiles, is employed together with available geophysical data on the ionosphere to evaluate reflections and transmissions during quiescent and disturbed propagation conditions. The reflection and transmissions in the ionosphere are determined rigorously with the aid of classical magneto-ionic theory. The complex indices of refraction of the medium are deduced, and a coupling in the plasma between ordinary and extraordinary, upgoing and downgoing modes of propagation is investigated. The corresponding reflection and transmission coefficients are calculated, and certain phenomena that can be expected as a result of the action of a solar disturbance on the reflection process are predicted. The particular disturbance, investigated to illustrate application of technique, was found to influence the reflection of transmitted l-f waves in the lower ionosphere in a complicated manner. However, the

high absorption phenomena exhibited by high frequencies does not seem to exist for the plasma profiles investigated at 1-f with the classical magneto-ionic theory. The electron collision frequencies of the classical theory can be readily modified to introduce a collision frequency proportional to electron energy. Since the new collision parameter, g, which replaces the classical constant, ν, in the equation of motion of an electron, is now complex and frequency dependent, some changes in the reflection coefficient detail can be anticipated. A preliminary investigation, however, indicates that the general conclusions of classical theory will not be seriously altered by these considerations for the examples investigated. (auth)

16847 PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE IONOSPHERE HELD AT IMPERIAL COLLEGE, LONDON, JULY 1962. London, The Institute of Physics and the Physical Society, 1963. 534p. Available from Chapman and Hall, Ltd., London. £5. 5s.

Seventy-four papers are included, 73 in English and one in French. Separate abstracts have been prepared for 40. The remaining 34 cover such topics as the irregularities and drifts in the ionosphere, and the mathematics of wave propagation through the ionosphere. (T.F.H.)

For abstracts of individual papers see: 16640, 16641, 16642, 16643, 16644, 16645, 16733, 16734, 16848, 16849, 16850, 16851, 16852, 16853, 16854, 16855, 16856, 16857, 16858, 16859, 16860, 16861, 16862, 16863, 16864, 16865, 16866, 16867, 16868, 16869, 16870, 16871, 16872, 16873, 16874, 16875, 16876, 16877, 17190, and 17191.

16848 IONOSPHERIC CONSTITUTION AND IONIZING RADIATIONS. H. Friedman (Naval Research Lab., Washington, D. C.). p.3-18 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The broad features of the structure of the atmosphere and its variability are described. Above 100 km, diffusive separation creates a composition dominated successively by atomic oxygen (200-800 km), helium (800-3000 km), and finally hydrogen (>3000 km). Molecular ions, O_2^+ and NO^+, characterize the lower ionosphere, and are gradually replaced at higher altitudes by the atomic ions O^+, He^+ and H^+. NO^+ is still present high in the F region and N^+ never exceeds a few per cent of the ion composition. The rate of ionization by solar x-ray and ultra-violet emission can be quite clearly defined, but the complex electron loss processes that control the relative importance of different wavelength regions in contributing to the equilibrium electron density are still not adequately understood. (auth)

16849 TEMPERATURE CONTROL OF THE STRUCTURE AND VARIATIONS OF THE QUIET IONOSPHERE. J. W. Wright (National Bureau of Standards, Boulder, Colo.). p.19-25 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The characteristic thickness and sub-peak electron content of the F region, obtained from hourly N(h) profiles since 1959 from seven ionospheric sounders distributed between 18°N and 77°N, are used to illustrate some features of the diurnal, seasonal, and solar-cycle variations of the F region. The F2 thickness is used to measure the neutral scale height at the F2 peak; its day-time seasonal and latitudinal variations are related to the total solar insolation, and suggest that corresponding variations in electron content may be explained by a time-varying loss rate and a change in the proportion of ionization attributed to atomic oxygen versus molecular nitrogen. The "seasonal anomaly" is thereby accounted for. A corpuscular component of heating is identified at Thule. (auth)

16850 A MODEL OF THE ATMOSPHERE AND IONOSPHERE IN THE E AND F1 REGIONS. R. B. Norton (National Bureau of Standards, Boulder, Colo.), T. E. Van Zandt, and J. S. Denison. p.26-34 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

It is shown that the rocket observations of solar flux against height in many solar lines are consistent with a model atmosphere based on rocket observations of the neutral atmosphere. In this model atmosphere the mean molar weight is smaller than in most other model atmospheres. With this model atmosphere, the observed solar fluxes, and the absorption and ionization cross sections, the rates of photoionization against height are computed. The peak rates in the E and F1 regions for overhead sun are about 4200 and 4400 ion pairs cm^{-3} sec^{-1} at about 110 and 140 km, respectively. With these data and the laboratory rate coefficients, where available, of the possible ionic reactions a model of the ionosphere in the E and F1 regions is constructed and compared with observed daytime electron and relative ion density profiles. The following conclusions may be drawn: N_2^+ is destroyed by the reaction $N_2^+ + O \rightarrow NO^+ + N$, rather than by dissociative recombination; photoionization of N_2 plays an important role in the formation of the E and F1 layers, about 75% of the ions in the E region at 110 km being derived from N_2^+; about 90% of the ions at 110 km are derived from photoionization by the 44-105 Å band; and the effective recombination coefficient in the E and F1 regions is of the order of 10^{-7} cm^3 sec^{-1} and decreases with temperature. (auth)

16851 TEMPERATURE VARIATION IN THE F REGION DURING THE LAST SUNSPOT CYCLE. W. Becker and P. Stubbe (Max-Planck-Institut für Aeronomie, Lindau/Harz, Ger.). p.35-42 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The curvature of the F2 layer peak was deduced from ionograms for noon periods on magnetically quiet winter days during the years 1953 to 1960. Its variation with sunspot number points at a long-term temperature variation from about 900 to 1400°K at the F layer peak from sunspot minimum to maximum. A similar close correlation was found for day-to-day variations during November 1958. (auth)

16852 ION TEMPERATURES FROM THE ELECTRON DISTRIBUTION ABOVE THE F2 LAYER MAXIMUM. S. A. Bowhill (Pennsylvania State Univ., University Park). p.43-9 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Measurements of total electron content between the earth and a satellite can readily be made using either dispersive Doppler or Faraday rotation measurements of radio signals transmitted from earth satellites. These measurements are frequently interpreted in terms of 'equivalent slab thickness,' namely, the thickness of a slab of ionization having the same column content as the ionosphere up to the satellite height, and density equal to the maximum density of the F2 layer. Using recent theoretical results concerning the mechanism of formation of the F2 peak in temperate latitudes, available measurements of equivalent slab thickness are interpreted to give estimates of the temperature above the F2 layer maximum.

These results are compared with values obtained by other techniques. (auth)

16853 THE DISTRIBUTION OF IONIZATION ABOUT THE MAGNETIC EQUATOR. W. J. Ross and L. J. Blumle (Pennsylvania State Univ., University Park). p.84-7 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Measurements of the electron content of the ionosphere made at Huancayo, Peru, and State College, Pennsylvania, using satellite radio signals, are presented and discussed. The diurnal variations of electron content and of equivalent slab thickness near equinox at the two sites are compared with particular reference to the relative importance of vertical diffusion. (auth)

16854 THE GEOMAGNETIC ANOMALY. A. J. Lyon (University Coll., Ibadan, Nigeria). p.88-93 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The variations of the noon values of the properties of the F2 region with magnetic latitude are shown for selected quiet days in each of three seasons during the I.G.Y., for three longitude zones over the latitude range ±50°. Variations of one type are nearly symmetrical relative to the magnetic equator at equinox, but show marked asymmetry in both solstices, with greater values in the winter than in the summer hemisphere over the whole range of latitudes studied. Variations of another kind indicate that the altitude of maximum ionization is always high over the region of the equatorial trough and has an asymmetrical latitude variation at the solstices, with lower levels in the winter than in the summer hemisphere. (auth)

16855 GEOMAGNETISM AND THE IONOSPHERE. C. O. Hines (Defence Research Board, Ottawa). p.103-15 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Interactions between the geomagnetic field and the ionosphere are reviewed. These, under the influence of the interplanetary plasma, determine the overall configuration both of the field and of the distant ionosphere. They include rotational interactions on the same scale, which serve to maintain much and perhaps all of the ionospheric medium co-rotating with the earth. On a somewhat smaller but still global scale they include tidal and storm phenomena, which alter both the field and the ionospheric characteristics and which probably play a major part in auroral and related phenomena. They occur in more localized fashion within ionospheric irregularities of various types, and on a shorter time scale in magnetically dominated waves, both hydromagnetic (in micropulsations) and magneto-ionic (in v.l.f. emissions). Salient features of all these interactions are discussed briefly, following an introductory review of the hydromagnetic and equipotential techniques that permit a succinct description of most of them. (auth)

16856 SOME RELATIONSHIPS BETWEEN MAGNETIC AND IONOSPHERIC VARIATIONS. J. W. King (Dept. of Scientific and Industrial Research, Slough, Bucks, Eng.). p.116-19 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The different night-time and day-time relationships between ionospheric phenomena and magnetic activity are described. It is shown that the relations do not have the same significance by day as at night. The apparent rate at which ionization is lost in the F layer at night is shown to depend on magnetic activity as well as on the height of the layer, and the apparent loss rates by day and by night are shown to be sharply contrasted. The average changes in the height of the F2 layer peak which occur during storms have been investigated and negative storms, which generally occur at middle latitudes in summer and at higher latitudes for most of the year, are shown to be associated with layer heights which are higher than normal. (auth)

16857 IONOSPHERIC VARIATIONS DURING GEOMAGNETIC STORMS. S. Matsushita (National Bureau of Standards, Boulder, Colo.). p.120-7 of "Proceedings of the International Conference on the Ionosphere." London, Institute of Physics and the Physical Society, 1963.

Different types of ionospheric data are used to investigate the ionospheric variations at the beginning of geomagnetic storms. Also, electron density profiles are used in studies of the average variations during storms. Soon after sudden commencements, an increase in ionization in the lower ionosphere often occurs at high latitudes; a variation in the height of the E layer occasionally appears at low latitudes. When geomagnetic micropulsations are associated with sudden commencements, the ionosphere also shows a similar period of oscillation. The storm-time and the disturbance local-time variations of each parameter of electron density profile data show a dependence on season and latitude. Relations are found between height and density variations. (auth)

16858 THE CHARACTERISTIC BEHAVIOUR OF THE F2 LAYER DURING SEVERE MAGNETIC STORMS. T. Yonezawa (Radio Research Labs., Tokyo). p.128-33 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Characteristic behavior of the F2 layer during severe magnetic storms, consisting of a sudden increase in height and a simultaneous sudden decrease in electron density followed by a more gradual recovery, observed at Kokubunji during the I.G.Y. is considered, and it is concluded that this behavior can be reasonably well interpreted in terms of heating of the upper atmosphere, which brings about enhancement of chemical reactions there. From analysis of observational data, temperature variations of the upper atmosphere and the average activation energy of the chemical reactions can be roughly inferred. The latter is found to be of the order of a fraction of one electron volt. (auth)

16859 IONOSPHERIC EFFECTS OF NUCLEAR DETONATIONS IN THE ATMOSPHERE. S. W. Lichtman and E. J. Andersen (Hughes Aircraft Co., Los Angeles). p.135-42 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Ionospheric disturbances of broad geographical coverage were propagated at sound velocity in the F2 region following detonation of multi-megaton nuclear devices in the low atmosphere over Novaya Zemlya. Propagation was radial from the source with no evidence of a magnetic meridian preference. For the event of 23rd October 1961, it is estimated that the ionospheric change that could be attributed to the explosion was greater than three times the quiet-day standard deviation (σ) of this quantity at distances less than 2300 km, and was greater than 2σ at distances greater than 4300 km. (auth)

16860 GEOMAGNETIC AGITATION AND OVERHEAD AURORA. W. L. Flock, A. E. Belon, and R. R. Heacock

(Univ. of Alaska, College). p.143-50 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The association of auroral activity with ionospheric currents and corresponding geomagnetic agitation has been studied by making use of the high sensitivity and time resolution obtainable with telluric current recordings. Simultaneous records have been taken at College, Alaska, of telluric currents and overhead optical aurora. Telluric currents at Barrow, Alaska, have been compared with overhead radio aurora, as observed with a 41 Mc radar, 540 km distant at Kotzebue, Alaska. Onsets of telluric current micropulsations accompany sudden increases in auroral luminosity. Telluric current and luminosity micropulsations show closely corresponding periods in the range from three to fifteen seconds. The correlations are the highest under conditions of overcast sky, indicating that the telluric currents respond to ionospheric currents throughout a large region of the sky. Onsets and other major features of radio aurora and telluric currents correspond closely, often to the nearest minute. (auth)

16861 THE RADIO AURORA IN HIGH LATITUDES. K. Bullough (Univ. of Sheffield, Eng.). p.151-4 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Observations of the radio aurora made at Dumont d'Urville (geomagnetic colatitude 14°) during the I.G.Y. are presented. The principal features are: aspect sensitivity is relatively unimportant in determining the distribution of radio echoes at Dumont d'Urville; the spatial configuration of reflecting regions divides into an inner and an outer zone of activity; and there are clear indications of a dependence of echo occurrence on the presence of sunlight at the auroral level. The characteristics of the radio echoes and their association with geomagnetic agitation are discussed. (auth)

16862 MICROPULSATION STUDIES AT BRISBANE, QUEENSLAND. I. PEARL PULSATIONS AND 'SCREAMERS.' J. S. Mainstone and R. W. E. McNicol (Univ. of Queensland, Brisbane). p.163-8 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Frequency–time plots of micropulsations in the 0.5 cps/region, recorded at Brisbane (35°S geomagnetic latitude), exhibit a characteristic striped pattern. This pattern consists of rapid upward frequency sweeps over a limited, well-defined range. The modulated wave form of pearl pulsations may be explained in terms of this structure. The time between successive frequency sweeps is constant (160 to 170 sec), but the slope of the sweep is variable. A characteristic train of pulsations with frequencies generally in the 1 cps range, lasting for periods of up to 5 or 6 hours, constitutes a "screamer." Screamers may consist of several bursts of activity whose average frequency rises appreciably from one burst to the next, but within each of which the frequency falls. Pearls with a recurrence period of 145 sec have been reported from Canada (60°N geomagnetic latitude); the period found in Brisbane is ~160 sec. A disturbance originating in the auroral zone, and propagated as hydromagnetic waves towards the equator, may account for this agreement over a considerable range of latitudes. (auth)

16863 MICROPULSATION STUDIES AT BRISBANE, QUEENSLAND. II. PULSATIONS OF THE Pc AND Pt TYPE. R. W. E. McNicol, J. S. Mainstone, and J. R. Wilkie (Univ. of Queensland, Brisbane). p.169-76 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Micropulsations in the period range 4 to 100 sec were recorded with equipment sensitive down to 0.01 γ sec^{-1} on both paper chart and magnetic tape. Analysis of the tapes was made with a sonagraph frequency spectrum analyzer, the tapes being speeded up by a factor of 44,000 on replay, so that one complete day's record appeared on each sonagram. It was found that Pc (continuous) pulsations were strongest during daylight hours, and had an amplitude which depended on planetary magnetic Kp index, being approximately 0.3 γ peak-to-peak when Kp = 3. The spread in the frequency spectrum of the Pc pulsations depended both on time of day and Kp index, being greatest at midday ranging then up to a maximum value which was proportional to Kp, being about 0.1 cps when Kp = 3. The lower limit of the frequency spectrum was almost independent of Kp index and time of day, being usually about 0.02 cps. When Kp = 0 the pulsations were not detectable on the chart records but could be seen weakly on the sonagrams during the daylight hours only, confined throughout this time to the frequency range 0.02 to 0.04 cps. Pulsations of Pt (transient) type could be distinguished from Pc on the sonagrams by their characteristically short duration and more widely spread frequency spectra. It was found that Pt's occurred most often in the late afternoon and at night, being most common around 2100 hours local time. The occurrence of Pt's also depended on the degree of magnetic activity, and was closely correlated with the occurrence of magnetic bays, the amplitude range of the Pt being proportional to the value of dH/dt for the associated bay. (auth)

16864 HEIGHT DISTORTION OF THE PEAK OF THE E REGION. G. M. Brown, W. J. G. Beynon, and A. D. Morgan (University Coll. of Wales, Aberystwyth). p.177-86 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The diurnal variation in the true height of the level of maximum electron density of the E region has been measured at Aberystwyth over an 18-month period during 1960 to 1961. The relative accuracy of the individual measurements is ±1 km. Comparison of the variations with simultaneous data for the direction of the overhead electric currents, derived from magnetic field recordings, establishes the existence of a small height distortion of maximum magnitude 1.8 km upwards at the time when the currents are directed east-west. The magnitude of the peak electron density is decreased at the same time. Mean vertical drift velocites of about 12 m sec^{-1} are required to account for the distortion in terms of electrodynamic motor action in the ionosphere, with a seasonal variation in the sense that velocities in summer are about 50% greater than those in winter. The order of magnitude of the vertical velocity is consistent with horizontal ionospheric drift velocities and dynamo theory, but the direction of the velocity derived from a simple motor theory is opposite to that of the change in height of the layer peak. (auth)

16865 WORLD-WIDE PATTERN OF IONIZATION DRIFTS IN THE IONOSPHERIC F REGION AS DEDUCED FROM GEOMAGNETIC VARIATIONS. H. Maeda (Kyoto Univ.). p.187-90 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

It is known that air movements in the ionosphere induce electric currents by dynamo action. Such currents flow mainly in the E region and set up an electrostatic field

there. This field seems to be communicated to the F region along highly conducting lines of geomagnetic force. The resulting electrostatic field in the F region gives rise to ionization drifts in that region under the influence of the geomagnetic field, and results in considerable distortion of the region. A world pattern of ionization drifts in the F region of the ionosphere is presented, as deduced from the dynamo theory of geomagnetic variations, and their effects on the distribution of ionization in the F region not only on quiet days but also on disturbed ones are discussed. (auth)

16866 CONDUCTIVITY OF THE IONOSPHERE AND THE DYNAMO CURRENT SYSTEM. K. Maeda (Kyoto Univ.) and H. Matsumoto. p.191-7 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The electron density profile N(h) in intermediate latitude is constructed from 60 to 400 km for each hour of the day, based on the results of observations by vertical sounding and of rocket and satellite experiments. The conductivity of the ionosphere is calculated and plotted against height. Then a dynamo-theoretical study is made on the current system for quiet and disturbed states of the ionosphere, taking into account the anisotropy of the conductivity. In the course of this study a particular feature of the effective total conductivity is found, which accounts for abnormal intensification of dynamo current in higher latitudes under the condition of enhanced electron density in the E and D regions. Also sharp bends in the current flow are seen near the boundary of two zones with different conductivities. (auth)

16867 THE INFLUENCE OF NEUTRAL AIR ON SEMI-DIURNAL AND DIURNAL DRIFTS IN THE F REGION. H. Kohl (Max-Planck-Institut fur Aeronomie, Lindau/Harz, Ger.). p.198-202 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Theories of tidal drifts in the F region either neglect the influence of neutral air entirely, or else they only introduce a frictional term in the equations of motion. It is important, however, to consider the equilibrium of vertical atmospheric stratification. The vertical component of the frictional drag, which acts upon the neutral air, is assumed to be cancelled by pressure gradients, and no vertical movement of neutral air occurs due to frictional forces. Tidal drifts of charged particles in the F region caused by electric fields in the dynamo-region are calculated, using the above assumption. The reduction factor depends essentially on the ion density. The formation of the F layer is discussed in the light of these results. (auth)

16868 THE OCCURRENCE OF DENSE SPORADIC-E AT MAGNETICALLY CONJUGATE POINTS AT HIGH LATITUDES. L. Thomas (Dept. of Scientific and Industrial Research, Slough, Bucks, Eng.). p.203-9 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The occurrence of dense sporadic-E (Es) at high latitude stations, situated near opposite ends of a geomagnetic field line, is examined for the equinox months of 1958. A significant association is found between dense Es occurring at a pair of stations located well inside the auroral zones; calculations based on ground level observations of the earth's magnetic field, suggest that the lines of force terminating at these stations extend in the equatorial plane to a distance of 12 to 15 earth radii from the earth's center. The association between dense Es occurring at this pair of stations is not dependent on the intensity of magnetic activity. It is found, however, that the dense Es observed simultaneously at these two stations tends to occur also at still greater latitudes during magnetically disturbed conditions, and at smaller latitudes during magnetically quiet conditions. The interpretation of these results is discussed. (auth)

16869 CONJUGATE POINT RELATIONSHIPS AT HIGH LATITUDES. K. B. Mather and E. M. Wescott (Univ. of Alaska, College). p.210-16 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Stations in the northern and southern hemispheres that are linked by the same magnetic field line show a close correspondence in their magnetic variations, telluric currents, aurorae, and ionospheric absorption. Information has been obtained at Cold Bay, Farewell, and Kotzebue in Alaska, the conjugate points of which are Oamaru in New Zealand, Campbell Island, and Macquarie Island, respectively. Auroral conjugacy has also been studied using the conjugate pair, Reykjavik in Iceland and the Japanese station Showa in Antarctica. Magnetic variations correlate well for the Cold Bay pair (field line reaching to 2.65 earth radii from the earth's center) and for the Kotzebue pair (5.2 earth radii). Telluric currents correlate extremely well for the Cold Bay pair, but for the Kotzebue pair the detailed correlation is less satisfactory although onset times of disturbances still correspond. Telluric currents often show elliptical polarizations, opposite in the northern and southern hemispheres. Aurorae have matching onset times and go through corresponding stages of development at the same times at the Farewell pair (4.1 earth radii). Ionospheric absorption shows good correlation for the Farewell and Kotzebue pairs. In all cases, except possibly auroral behavior, there is evidence for a relationship between conjugate areas rather than points. Studies of auroral forms may lead to a more precise point-to-point relationship. (auth)

16870 DIFFUSION OF IONS BETWEEN F LAYERS AT MAGNETIC CONJUGATE POINTS. P. Rothwell (Univ. of Birmingham, Eng.). p.217-21 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Ionospheric F layers at magnetic conjugate points in opposite hemispheres may be coupled by diffusion of ions along magnetic lines of force of the earth's field, if many hydrogen ions in the exosphere originate in the F layer from the charge exchange reaction $H + O^+ \rightarrow H^+ + O$. Ion-ion diffusion times are strongly temperature-dependent (T^{-3}), and F layers in opposite hemispheres are probably in quasi-equilibrium by day, but not by night. Anomalous seasonal variations can be accounted for by small summer–winter temperature differences at the ends of the lines of force in opposite hemispheres. The morphology of ionospheric storms can be explained qualitatively in terms of increased diffusion rates between conjugate ionospheres during magnetically disturbed periods. (auth)

16871 EXTRA-TERRESTRIAL CORPUSCULAR STREAMS AND POLAR MAGNETIC DISTURBANCES. N. Fukushima, T. Nagata, and T. Oguti (Tokyo Univ.) p.223-9 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

A particular solar-daily variation in the geomagnetic field of considerable magnitude is observed in the sunlit polar-cap region even on quiet days, the current-system of which resembles the polar-cap part of local-disturbance

current flow. Furthermore some geomagnetic disturbance is almost always present near the geomagnetic poles even when world-wide geomagnetic conditions are quiet, and this residual disturbance is especially large in the sunlit polar region. The presence of these variations confined to the polar-cap region is evidence of the interaction of the persistent solar wind with the geomagnetic field. From the spherical harmonic analysis of world-wide geomagnetic observations made at ground level, the deformation of the lines of magnetic force in the earth's magnetosphere can be estimated, especially for the early stage of a magnetic storm. The ionospheric and auroral phenomena in the auroral zone accompanying a simple and small geomagnetic bay disturbance can be quantitatively explained by the precipitation of electrons of about 10 kev energy. But in order to explain the geomagnetic variation at the time of severe disturbances or a kind of giant pulsation of long period, it seems necessary to introduce an electromotive force from outside the ionospheric region. (auth)

16872 HYDROMAGNETIC WAVES AND THE IONOSPHERE. J. W. Dungey (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.230-2 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Calculations usually take the wave normal to be vertical and then show that the electric field in the ionosphere is very small. There must be some horizontal variation of the wave, however, and this is shown to be important. If the magnetic perturbation is perpendicular to the wave normal, the electric field in the ionosphere is bigger by a factor of (free space wavelength/horizontal scale)^2. Conductivity below the D region is important, but it is clear that the lines of force oscillate almost as though their ends were free. If the electric perturbation is perpendicular to the wave normal, the earlier calculations are valid and the ends of the lines of force are nearly fixed. (auth)

16873 SUMMARY—GEOMAGNETISM AND THE IONOSPHERE. C. O. Hines (Defence Research Board, Ottawa). p.233-6 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

An outline is given of papers on the interactions between the geomagnetic field and the ionosphere, ionospheric and geomagnetic noise, geomagnetic and auroral activity, and periodic variations at various latitudes. (T.F.H.)

16874 IONOSPHERIC IRREGULARITIES AND MOVEMENTS. K. Rawer (Ionosphären Institut, Breisach, Ger.). p.239-51 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The types of irregularity that occur in the D, E, and F regions, and the methods of observing their form and movement, are surveyed briefly. Measurements of the movements of meteor trails, observations of stratification within the E layer and of Es ionization, the use of the fading of reflected radio waves and of radio-star and satellite scintillations, and various observations of medium- and large-scale irregularities in the F region, are all discussed. A summary is presented of the results of systematic drift observations. The various theoretical approaches to the problem of the formation and movement of the irregularities are compared. (auth)

16875 MULTIPLE SCATTERING IN THE AURORAL IONOSPHERE. L. Owren (Univ. of Alaska, College). p.277-84 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

The equation of radiative transfer is solved for a thick, plane-parallel ionosphere containing weak, anisotropic scatters, and the conditions that radio interferometer recordings of discrete sources show zero visibility are stated analytically. Observational data on visibility fades of radio star signals traversing the auroral ionosphere are summarized and indicate that the multiple scattering region is in the 400 to 900 km height range. This has been confirmed by a satellite observation which also indicated simultaneous occurrence of strong backscatter. Selected observations during auroral activity lead to an optical thickness of about 4 for the diffracting layer and lateral scale dimensions for the irregularities of 10 to 40 mi. Description of the irregularities by a Gaussian autocorrelation function provides a reasonable first-order theory for the forward scatter field but fails to account for backscatter. (auth)

16876 THE NON-RELATIVISTIC DOPPLER SHIFT IN THE IONOSPHERE. P. R. Arendt (Army Electronic Research and Development Lab., Fort Monmouth, N. J.). p.331-5 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Doppler frequency scintillations depend on the changes in the geometric length of the path that are produced by the temporal variations of the electron density along the path. They also depend on the integrated value of these density variations. An approximation for the total value of scintillations is derived and compared with statistical data from satellite observations. The average time variation of the integrated electron density is obtained. This value establishes a natural uncertainty for frequency measurements with outer space satellite signals. (auth)

16877 THE ELECTRON DENSITY PROFILE ABOVE THE F2 REGION OF THE IONOSPHERE AS RECORDED BY THE SATELLITE ARIEL. J. Sayers (Univ. of Birmingham, Eng.). p.523-5 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

A description is given of the r-f plasma probe on the satellite Ariel, together with some electron density measurements obtained using the probe. These measurements seem to indicate the presence of a further ledge of ionization above the maximum of the F2 layer, the height of the new layer varying from about 700 km at local noon to about 1000 km at local midnight. (auth)

Low Temperature Physics

Refer also to abstract 16814.

16878 (SSD-TDR-63-98) ELECTRONICS RESEARCH PROGRAM. LOW-TEMPERATURE ELECTRONICS. Semiannual Technical Note, July 1–December 31, 1962. F. L. Vernon, Jr. (Aerospace Corp., El Segundo, Calif.). Apr. 29, 1963. Contract AF04(695)-169. 22p. (TDR-169 (3250-13)TN-1)

The initial experimental work on the high-field superconducting characteristics has started with an investigation of the effect of grain size on the critical field-critical current ($H_c - I_c$) relationship. Measurements have been made which show an anomalous behavior of H_c versus I_c for a certain range of grain sizes. Initial experiments on the properties of superconducting thin filaments have been performed on samples consisting of lead imbedded in a

copper matrix. The results have indicated that size-dependent behavior occurs before it would be expected on a theoretical basis. It is possible that the normal copper electrons are severely affecting the superconducting properties of the lead. (auth)

16879 NONLINEAR REACTANCE AND FREQUENCY CONVERSION IN SUPERCONDUCTING FILMS AT MILLIMETER WAVELENGTHS. A. S. Clorfeine (RCA Labs., Princeton, N. J.). Appl. Phys. Letters, 4: 131-2(Apr. 1, 1964).

Millimeter-wave amplification requirements were met for a superconducting film. The inductance of the film was varied at the rate of 108 Bc/sec, a significant shift in the resonant frequency of a superconducting cavity was produced with less than one milliwatt of millimeter-wave power, and the simultaneous application of two frequencies resulted in the creation of an idler frequency. The films were 100 Å thick and were at 1.8 to 2.2°K. (R.E.U.)

16880 A SUPERCONDUCTING MAGNET WITH INDUCTIVE EXCITATION. V. R. Karasik, R. Sh. Akchurin, and S. Sh. Akhmedov (Physical Inst., Academy of Sciences, USSR). Cryogenics, 4: 44(Feb. 1964).

A liquid-helium-cooled superconducting magnet with inductive excitation is described. The maximum magnetic field possible is 20 koersted. (R.E.U.)

16881 TIME EFFECTS IN SUPERCONDUCTIVITY. J. Lowell and K. Mendelssohn (Clarendon Lab., Oxford). Cryogenics, 4: 48(Feb. 1964).

A slow return of the normal resistance of a superconducting cylindrical crystal of 92.5 at. % Ta and 7.5 at. % Nb is reported in fields up to 100% in excess of the critical value at the boiling temperature of helium. (R.E.U.)

16882 DECREASE OF ELECTRON TEMPERATURE BY ELECTRIC FIELDS. V. V. Paranjape (Univ. of Liverpool) and T. P. Ambrose. Phys. Letters, 8: 223-5(Feb. 15, 1964).

It is shown by extending the calculations of Stratton of integrals in the optical scattering equations to include higher order terms that the presence of weak electric fields in semiconductors may decrease the electron temperature, T, below the lattice temperature, T_0, although the total energy change, $E-3_2kT_0$, is always positive. (L.B.S.)

16883 CRITICAL TRANSPORT CURRENT BEHAVIOUR IN A SEMI-REVERSIBLE TYPE II SUPERCONDUCTOR. M. A. R. Leblanc (Aerospace Corp., Los Angeles and Univ. of Southern California, Los Angeles). Phys. Letters, 8: 226-7(Feb. 15, 1964).

The behavior of the critical transport current in two niobium wires was observed. The critical current and the magnetization were measured in longitudinal and transverse magnetic fields and the results of reversing the field and current direction with suitable treatment of the wires indicate the dependence of the critical current of a nonideal type II superconductor on the polarity of the current. It is also shown that the upper critical field can be obtained from the critical current curve in a longitudinal field, and the critical current behavior in a transverse field agrees with the modified Silsbee rule. (L.B.S.)

16884 FOUR CRITICAL FIELDS IN SUPERCONDUCTING INDIUM LEAD ALLOYS. S. Gygax (Swiss Federal Inst. of Tech., Zurich), J. L. Olsen, and R. H. Kropschot. Phys. Letters, 8: 228-30(Feb. 15, 1964).

Data on some polycrystalline indium-lead alloys that confirm the presence of superconductivity in fields greater than the upper critical field and show the temperature dependence and concentration dependence of the four critical fields at solute concentrations up to 6% Pb are presented. (L.B.S.)

16885 CHANGE OF ENERGY GAP WITH A MAGNETIC FIELD IN SUPERCONDUCTING FILMS. C. Di Castro and J. G. Valatin (Univ. of Birmingham, Eng.). Phys. Letters, 8: 230-1(Feb. 15, 1964).

An equation for the determination of the variation of the energy gap with magnetic field in superconducting films is derived by assuming the gap parameter is a known function of the field and performing a second order perturbation calculation. The solution to the equation is presented in curves for the change in energy gap as a function of magnetic field strength for tin film thicknesses ≤ 50 and $\gg 500$ Å. (L.B.S.)

16886 LOW-TEMPERATURE HEAT CAPACITIES OF GALLIUM, CADMIUM, AND COPPER. Norman E. Phillips (Univ. of California, Berkeley). Phys. Rev., 134: A385-91 (Apr. 20, 1964).

The heat capacities of gallium, cadmium, and copper were measured from 0.1 or 0.2°K to 4.2°K. The experimental data for copper suggest that the measurements are accurate to within 3% at 0.1°K and to within 1% at temperatures above 0.2°K. In the superconducting state both gallium and cadmium show the typical deviations from the BCS law of corresponding states. The nuclear quadrupole contribution to the heat capacity of gallium was observed in the normal state but not in the superconducting state. The absence of this contribution in the superconducting state can be used to set an approximate lower limit of 60 sec for the spin-lattice relaxation time at 0.25°K. For cadmium $\theta_0 = 209.0 \pm 2.3$°K, in reasonable agreement with the value calculated from the elastic constants. (auth)

16887 SUPERCONDUCTIVITY IN MANY-VALLEY SEMICONDUCTORS AND IN SEMIMETALS. Marvin L. Cohen (Univ. of Chicago). Phys. Rev., 134: A511-21 (Apr. 20, 1964).

It is shown that the attractive electron-electron interaction arising from the exchange of intravalley and intervalley phonons can be larger than the repulsive Coulomb interaction in many-valley semiconductors and semimetals and can cause these materials to exhibit superconducting properties. The importance of observing a superconducting transition in these materials and the properties required of a semiconductor or semimetal to maximize its superconducting transition temperature are discussed. (auth)

16888 SUPERCONDUCTIVITY IN GERMANIUM TELLURIDE. R. A. Hein (Naval Research Lab., Washington, D. C.), J. W. Gibson, R. Mazelsky, R. C. Miller, and J. K. Hulm. Phys. Rev. Letters, 12: 320-2(Mar. 23, 1964).

Changes in susceptibility of GeTe with temperature and sample composition are shown in transition curves for four pressed and sintered samples. Measurements show that GeTe becomes superconductivity in the predicted temperature range. A plot of the transition temperatures as a function of the carrier concentration is also shown. (L.B.S.)

16889 SILSBEE-LIMIT CRITICAL CURRENTS IN A 1700 Å FILM OF TIN. F. B. Hagedorn (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters, 12: 322-5(Mar. 23, 1964.

New pulse measurements of critical currents obtained from an evaporated film of tin of thickness 1700 Å are reported. From a plot of the normalized resistance as a function of time with measuring current as a parameter,

the critical current was determined to be 23.4 amp. The measured critical currents are plotted as a function of the reduced bath temperature squared and are shown to be in good agreement with the Silsbee current over the entire temperature range. (L.B.S.)

Neutron Physics

16890 (EUR-596.e) FINITE DIFFERENCE METHOD FOR SOLVING THE SPATIO-TEMPORAL DIFFUSION EQUATION IN THE TWO-GROUP APPROXIMATION. COMPARISON BETWEEN THE SOLUTION BY AN ITERATIVE AND A DIRECT METHOD. R. Monterosso and E. Vincenti (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy and European Atomic Energy Community. European Scientific Data Processing Center, Ispra, Italy). 1964. 36p.

The two spatio-temporal diffusion equations of the two-group approximation are transformed into a system of linear equations, by means of the finite difference method. This system can be divided into two systems, fast and thermal. They are solved separately and each solution is used as source for the other system. The process is iterated until it converges. With a convenient disposition of the equations in the system, the matrix of the coefficients can be transformed into a tri-diagonal matrix of 2×2 submatrices. The whole system can be solved directly. A comparison between the two methods is made with numerical examples. (auth)

16891 (GA-4881) INTEGRAL NEUTRON THERMALIZATION. Quarterly Progress Report for the Period Ending December 31, 1963. J. R. Beyster, G. D. Joanou, J. Kirkbride, J. U. Koppel, J. M. Neill, J. A. Young, and J. C. Young (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Jan. 15, 1964. Contract AT(04-3)-167. 38p.

Data were presented on spectral and reactivity measurements in an assembly of UF_4 and paraffin, the sensitivity of BF_3 detector banks, fast neutron penetration in water, the scattering kernel for polyethylene, lattice vibrational spectrum of magnesium, and the specific heat of magnesium. (C.E.S.)

16892 (JUL-140-RX) NEUTRONENMESSUNGEN MIT EINEM PARAFFINMEILER. (Neutron Measurements in a Paraffin Pile). G. Borchardt and U. Schneider (Kernforschungsanlage. Institut für Reaktorexperimente, Jülich, Germany). May 1963. 65p.

Relative and absolute measurements of the thermal and epithermal neutron flux in a cylindrical pile of paraffin containing a C–Ra–Be source are discussed. The measurements were performed using 0.020-mm thick, circular Au disk foils of 1 cm^2 area. The results (for Cd ratios, the removal cross section, the experimental FERMI age, the spatial flux integral, etc.) were found to be in accordance with results obtained elsewhere. The neutron source strength was determined to be 7.60×10^6 n/sec, which differs not inadmissibly from the calibration value 7.81×10^6 n/sec of the source. (auth)

16893 (KAPL-M-6119) FICS—A PROGRAM TO COMPUTE FEW-GROUP CONSTANTS WITHIN THE KARE DIFFUSION THEORY SYSTEM. REVISION III. D. E. Goodman (Knolls Atomic Power Lab., Schenectady, N. Y.). Feb. 28, 1964. Contract W-31-109-eng-52. 84p.

The computer program FICS computes diffusion constants and macroscopic cross sections for slowing down, absorption, ν-fission, and total removal in two, three, or four energy groups for each compositional region in the reactor model. The one-group thermal constants are provided by a variational technique which computes an approximate Wigner-Wilkins flux spectrum as a linear combination of two trial spectra. The thermal group constants are determined by averaging lethargy-dependent microscopic cross sections and diffusion constants over the composite spectrum. The thermal constants are temperature-dependent, with region temperatures from 68 to 600°F permitted. In the fast energy range (10 Mev to 0.625 ev) the program computes temperature-independent constants in one, two or three energy groups. These are determined from stored microscopic cross sections which were obtained by curve fitting to MUFT parameters over a wide range of metal-water ratios. Optional calculations, some of which modify one group constants for special purposes, while others prepare and transmit data to other segments, are provided. (auth)

16894 (MIT-3031-1) NEUTRON DIFFRACTION LABORATORY ANNUAL PROGRESS REPORT, JANUARY 1, 1963–DECEMBER 31, 1963. (Massachusetts Inst. of Tech., Cambridge). Feb. 1964. Contract AT(30-1)-3031. 7p.

Neutron diffraction studies are reported on magnetic spin distribution in magnetic crystals along with spatial, directional, and correlational effects. Topics covered include: magnetic scattering of neutrons by hexagonal cobalt, magnetic spin correlations in MnO, magnetic diffuse scattering by iron near the Curie temperature, mirror reflection of monochromatic neutrons, neutron spin-orbit scattering by vanadium and alpha-quartz, neutron scattering by superconducting crystals of V_3Si, coherent scattering by ferromagnetic iron-palladium alloys, magnetic structure of Mn_3O_4, and magnetic structure of nickel. (N.W.R.)

16895 (NP-13662) TEORIYA REZONANSNOGO POGLOSHCHENIYA NEITRONOV V SREDAKH. (Theory of Resonance Absorption of Neutrons in Media). A. A. Luk'yanov and V. V. Orlov (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 25p.

Theoretical and experimental data on neutron resonance absorption were reviewed, and the temperature dependence of effective resonance integrals for uranium and uranium oxide in homogeneous and heterogeneous systems was discussed within the limitations of "narrow resonance" approximation. The general concept of resonance absorption in a block is based on the integral equation for mean neutron collision density in a block. The resonance absorption by a separate block, placed in an infinite moderator, was studied assuming that resonances are narrow in relation to neutron elastic scattering on external moderator nuclei. Integral equations for the total number of neutron collisions within a block per unit time were developed using the complete neutron flux in a $\psi(u)$ block presented as a sum of neutrons incident on the external moderator block and neutrons moderated to an assigned energy. (R.V.J.)

16896 (NP-13720) THE BACKSCATTERING OF FAST NEUTRONS FROM PLANE AND SPHERICAL REFLECTORS. M. Leimdoerfer (Sweden. Försvarets Forskningsanstalt, Stockholm). Mar. 1964. 36p.

The Monte Carlo method has been used for a study of neutron backscattering from plane and concave spherical reflectors of hydrogen, water, concrete, aluminum, iron, and uranium. A calculation technique, initially designed to be efficient for deep penetration calculations, is applied with only a simple alteration, reversing the bias to promote the migration of neutrons back toward the source. (auth)

16897 (UCRL-7624) SOPHIST-5—AN IBM 7090/7094 FORTRAN II CODE WHICH CALCULATES MULTIGROUP ENERGY TRANSFER MATRICES FOR ANISOTROPIC ELASTIC SCATTERING OF NEUTRONS. Eugene Canfield (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 18, 1963. Contract W-7405-eng-48. 19p.

The computer program SOPHIST-5, in FORTRAN II for the IBM 7090/7094, calculates anisotropic-elastic scattering matrices for multigroup neutronic calculations. The output is suitable for diffusion or transport-corrected SN codes of 120 groups or less. The input uses cross sections expressed as Legendre expansions (through l = 6) in terms of laboratory or center-of-mass scattering cosines. The theory is presented, and input and output are discussed. A sample problem is also included. (auth)

16898 A RIGOROUS DERIVATION OF SOME INVARIANT IMBEDDING EQUATIONS OF TRANSPORT THEORY. P. B. Bailey (Sandia Corp., Albuquerque, N. Mex.). J. Math. Anal. and Appls., 8: 144-69(Feb. 1964). (TID-18327; SCDC-3111)

The invariant imbedding equations are obtained rigorously from the Boltzmann formulations for cases of time-dependent transport in a rod, steady-state transport in a slab, and steady-state transport in a hollow sphere, a solid sphere, and a spherical shell enclosing a perfect absorber. (M.J.T.)

16899 A CORRECTION TO SOME INVARIANT IMBEDDING EQUATIONS OF TRANSPORT THEORY OBTAINED BY "PARTICLE COUNTING". P. B. Bailey and G. M. Wing (Sandia Corp., Albuquerque, N. Mex.). J. Math. Anal. and Appls., 8: 170-4(Feb. 1964). (TID-18328; SCDC-3113)

Comparison of a rigorously derived invariant imbedding equation for transport in a sphere with one obtained by particle-counting methods shows that a term is missing from the latter. This error, due to a geometrical effect, is corrected by a more careful application of the particle-counting technique. (M.J.T.)

16900 THE MILNE PROBLEM FOR A SEMI-INFINITE MEDIUM WITH ANISOTROPIC SCATTERING AND ABSORPTION OF NEUTRONS. L. M. Romanova. J. Nucl. Energy, Pt. A & B, 17: 559-69(Dec. 1963). Translated by A. Lorenz from the Russian work "Some Mathematical Problems in Neutron Physics (1960)."

The steady-state neutron flux distribution in a semi-infinite medium Z > 0 and the angular distribution of neutrons leaving the plane Z = 0 are determined. (R.E.U.)

16901 FLUX DISTRIBUTION OF THERMAL NEUTRONS INSIDE A STACK OF FOILS. J. L. Alvarez Rivas (Junta de Energia Nuclear, Madrid). J. Nucl. Energy, Pt. A & B, 17: 572-3(Dec. 1963).

Application is made in plane geometry of the validity of Fick's law for rods of infinite length and of diameter near the absorption mean free path. Previous data for gold- and iridium-foil stacks (ORNL-3193) are reviewed, and relative neutron distributions are obtained. (R.E.U.)

16902 CONSTRUCTION OF A GENERATOR OF 14-Mev POLARIZED NEUTRONS. M. Heyman, J. Marvaud, and R. Sene (College de France, Paris). J. Phys. (Paris), 24: 960-2(Nov. 1963). (In French)

Polarized deuterons produce, in the $T(d,n)^4He$ reaction at the resonance (E_d = 107 kev), partially polarized monoenergetic neutrons. In order to obtain these deuterons, a deuterium beam is polarized by separation of the hyperfine structure components in an inhomogeneous magnetic field, and by subsequent adiabatic transition between two degenerate levels. Ionization is produced by a low-pressure h-f discharge. Expected intensity is 1 μA. (auth)

16903 SOME NOTES ABOUT THE CONCEPTION OF NEUTRON DENSITY, NEUTRON FLUX, AND NEUTRON TEMPERATURE. D. Albert (Zentralinstitut für Kernforschung, Bereich Reaktortechnik und Neutronenphysik, Rossendorf, Ger.). Kernenergie, 7: 78-83(Feb. 1964). (In German)

The theoretical basis for defining neutron fluxes within certain energy spectra is discussed. The case of thermal neutrons was considered of special interest. The neutron temperature is treated not as a thermodynamic quantity but as a spectrum parameter instead. Ambiguities arose when regarding spectra that deviated from a Maxwell distribution. It is suggested, that the mean energy be agreed upon as basis for the definition of neutron radiation parameters. The spectrum equation for a heavy gas with P_1L_2 approximation was derived in the density and flux notation. (OTS)

16904 ION SOURCE FOR NEUTRON TUBES WITH CONTROLLED ION CURRENT. E. P. Gel (All-Union Instrument Research Inst., Volga, USSR). Pribory i Tekhn. Eksperim., No. 6, 38-41(Nov.-Dec. 1963). (In Russian)

The construction of an ion source that operates similar to the conventional vacuum triode is described for use in a neutron generating tube. The ion current at the target and, therefore, the neutron yield is controlled by the voltage on the special grid that is located between the region of gas discharge and the accelerating gap of the tube. The neutron beam has a wide range of control. (tr-auth)

Nuclear Properties and Reactions

Refer also to abstracts 16329, 16516, 16775 and 17287.

16905 (ANL-6848) NUCLEAR SPECTROSCOPY WITH DIRECT REACTIONS. I. CONTRIBUTED PAPERS. F. E. Throw, ed. (Argonne National Lab., Ill.). Mar. 1964. Contract W-31-109-eng-38. 257p.

Separate abstracts were prepared for 36 of the 39 papers included. Three other papers on multiparticle excitation in the intermediate compound state, Ca^{41} and Ca^{49} shell-model levels, and (p,t) and (He^4,He^6) reactions on Mg^{26} were previously abstracted in NSA. (D.C.W.)

For abstracts of individual papers see: 16906, 16907, 16908, 16909, 16910, 16911, 16912, 16913, 16914, 16915, 16916, 16917, 16918, 16919, 16920, 16921, 16922, 16923, 16924, 16925, 16926, 16927, 16928, 16929, 16930, 16931, 16932, 16933, 16934, 16935, 16936, 16937, 16938, 16939, 16940, and 16941.

16906 (ANL-6848(p.2-7)) THE VALIDITY OF THE WKB APPROXIMATION FOR HIGH-ENERGY DISTORTED-WAVE CALCULATIONS. Daphne F. Jackson (Washington. Univ., Seattle).

The results of comparisons of partial-wave and WKB calculations in the zero-range distorted-wave Born approximation for the (p,p'), (p,d), and (p,2p) reactions on light nuclei at incident proton energies from 90 to 200 Mev are summarized. (D.C.W.)

16907 (ANL-6848(p.8-15)) STUDIES OF THE $O^{16}(He^3,\alpha)O^{15}$ AND $O^{16}(He^3,He^3)O^{16}$ REACTIONS. W. P. Alford, L. M. Blau, and D. Cline (Rochester, N. Y. Univ.).

The $O^{16}(He^3,\alpha)O^{15}$ reaction leading to the ground state of O^{15} was investigated, and the results were analyzed using the distorted-wave Born approximation program SALLY.

The elastic scattering of He^3 from O^{16} was studied over the same energy range in order to establish the optical-model potentials for the DWBA calculation. The optimum optical-model parameters are given. Generally reasonable agreement with the experimental angular distribution was obtained. The results also indicate that the reaction will yield reliable spectroscopic information even at relatively low energies. (auth)

16908 (ANL-6848(p.16-23)) MEASUREMENT OF THE NEUTRON POLARIZATION AND CROSS SECTIONS FOR THE $C^{12}(d,n)N^{13}$ REACTION BETWEEN 2.8 AND 4 Mev. R. L. Walter, J. R. Sawers, and F. O. Purser (Duke Univ., Durham, N. C.).

Angular distributions and yield curves for the reaction were obtained. The resulting cross sections were in agreement with other determinations, but the angular distributions at higher energies differed from Verba's differential cross section data. The energy distribution of the polarization agreed with Haeberli's data. The polarization angular distributions were combined in a contour plot. Above 3.6 Mev, the contour lines tend to be horizontal, as would be expected for direct interaction. The polarization distributions were separable into three groups. The higher-energy (3.6–4.0 Mev) groups are similar to polarization data for the $C^{12}(d,p)$ reaction at 6 to 15 Mev. (D.C.W.)

16909 (ANL-6848(p.30-7)) DISTORTED-WAVE ANALYSIS OF THE $Zr^{90}(d,p)Zr^{91}$ STRIPPING REACTION. William R. Smith (Oak Ridge National Lab., Tenn.).

The $Zr^{90}(d,p)Zr^{91}$ reaction at 10.85 Mev was analyzed to investigate the sensitivity of the spectroscopic factors and the stripping data to different selections of elastic scattering parameters. The optical potentials are described, together with the derivation of the deuteron and proton parameters. The parameters were used to calculate $Zr^{90}(d,p)Zr^{91}$ stripping angular distributions from which spectroscopic factors were obtained. The parameters and factors (also, their deviations) are tabulated. Stripping polarizations were also calculated. The results and their implications are discussed. (D.C.W.)

16910 (ANL-6848(p.38-42)) EXACT EXPRESSIONS FOR COULOMB-WAVE STRIPPING AMPLITUDES. Fernanco B. Morinigo (California Inst. of Tech., Pasadena).

Analytic expressions for first-order scattering amplitudes, calculated on the assumption that the relative motions of the nuclear fragments in both initial and final states can be described as pure Coulomb waves, are presented. (auth)

16911 (ANL-6848(p.43-50)) EFFECT OF FINITE-RANGE n-p POTENTIAL IN COULOMB STRIPPING REACTIONS. Arthur K. Kerman (Massachusetts Inst. of Tech., Cambridge and Faison P. Gibson (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.).

The differential cross sections for $Bi^{209}(d,p)$ reactions in the Coulomb stripping region were calculated with a zero-range distorted-wave Born approximation program modified to incorporate finite-range and polarization effects. Reduced widths were also obtained. It was concluded that these effects usually increase the differential cross section and reduce the estimate of the physical reduced width by not more than about 16%, indicating that the zero-range approximation is quite good in this region. (D.C.W.)

16912 (ANL-6848(p.52-62)) A STUDY OF THE REACTION $U^{238}(d,p)U^{239}$. B. E. F. Macefield (Oxford Univ.) and R. Middleton (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England).

The level structure of U^{239} was investigated by the $U^{238}(d,p)$ reaction at 12 Mev. Twenty-four proton groups were identified in the spectrum from the reaction. The level excitations are given, together with the angular distributions for the first twelve groups. The data were analyzed by the distorted-wave Born approximation and the Nilsson model. The optical-model parameters used are tabulated, together with the cross sections and level characteristics obtained. The predicted angular distributions and absolute intensities are in fair agreement with experiment. (D.C.W.)

16913 (ANL-6848(p.63-9)) DISTORTED-WAVE ANALYSIS OF THE $Cr^{52}(d,p)Cr^{53}$ REACTION USING MEASURED OPTICAL-MODEL PARAMETERS. J. C. Legg, H. D. Scott, and M. K. Mehta (Rice Univ., Houston, Tex.).

The angular distributions for the elastic scattering of deuterons from Cr^{52} and Cr^{53} and for the proton groups from the $Cr^{52}(d,p)Cr^{53}$ reaction were measured at several deuteron energies. Optical-model fits for the elastic scattering data were obtained, and the optical-model potentials were used in distorted-wave calculations for the d,p reaction. The results show that when a radial cutoff is used in the integration, the distorted-wave calculation is in acceptable agreement with experiment. (D.C.W.)

16914 (ANL-6848(p.70-8)) A STUDY OF STRIPPING AND PICKUP REACTIONS ON C^{12}, C^{13}, AND C^{14}. R. N. Glover (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England) and A. D. W. Jones (Oxford Univ.).

The results of an investigation of the (d,p), (d,t), (p,d), and (t,d) reactions on C^{12}, C^{13}, and C^{14} at 8 and 12 Mev are presented and are discussed in relation to other data. Reduced widths were obtained using plane-wave theory. The widths are tabulated, together with the other level and reaction parameters obtained. (D.C.W.)

16915 (ANL-6848(p.79-85)) LOW-LYING LEVELS IN Ti^{48} OBSERVED IN THE (d,p) REACTION. P. D. Barnes, C. K. Bockelman (Yale Univ., New Haven); O. Hansen (Copenhagen. Universitet. Institut for Teoretisk Pysik); and A. Sperduto (Massachusetts Inst. of Tech., Cambridge).

Proton energy spectra for the $Ti^{47}(d,p)Ti^{48}$ reaction at 6 Mev were obtained at 23 angles (7.5 to 172.5°), and the angular distribution for each Ti^{48} level was determined. Preliminary results of a distorted-wave Born approximation analysis of the distribution data are presented. The optical-model parameters are included, together with the observed scheme of the first eight levels. Values of the orbital angular momentum of the captured neutron and spin and parity assignments suggested by the analysis are discussed. (D.C.W.)

16916 (ANL-6848(p.86-97)) A HIGH-RESOLUTION STUDY OF (d,p) REACTIONS ON TARGETS OF W^{182}, W^{184}, AND W^{186}. John R. Erskine (Argonne National Lab., Ill.).

Proton spectra and angular distributions for (d,p) reactions on W^{182}, W^{184}, and W^{186} at 12 Mev were measured. The excitation energies and Q values observed for the lower levels of W^{183}, W^{185}, and W^{187} are tabulated, together with captured neutron orbital angular momenta assignments for the lower levels. Proton spectra for the reactions and excitation energies, wave functions, and differential cross sections for the levels of W^{183}, W^{185}, and W^{187} were calculated by the model of a rotator plus an odd nucleon. The differential cross sections reveal large effects of band mixing, particularly for W^{185}. Assignments of J and K for lower levels were also made. Comparison of

experiment and theory indicates that the spins and intrinsic states were correctly identified and that the model used gives a reasonably valid description of low-lying W^{185} and W^{187} levels. (D.C.W.)

16917 (ANL-6848(p.98-103)) A STUDY OF (d,n) REACTIONS ON Fe^{54} AND Ni^{58}. D. S. Gemmell, L. L. Lee, Jr., J. P. Schiffer, and A. B. Smith (Argonne National Lab., Ill.).

The neutron spectra from (d,n) reactions on Fe^{54} and Ni^{58} were measured using a pulsed, 7-Mev deuteron beam. Neutron groups were identified, and the angular distributions for the groups were obtained. By comparison of the distributions with those calculated by the distorted-wave Born approximation, assignments for the orbital angular momenta of the captured protons in some Co^{55} and Cu^{59} levels were made. (D.C.W.)

16918 (ANL-6848(p.104-5)) A NOTE ON THE REACTIONS $Mg^{26}(d,p)Mg^{27}$ AND $Mg^{26}(t,d)Mg^{27}$. R. N. Glover (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England).

The reactions $Mg^{26}(d,p)Mg^{27}$ and $Mg^{26}(t,d)Mg^{27}$ were studied at 6 and 10 Mev using a multichannel spectrograph. The (d,p) experiment shows that the 3.78-Mev level of the 3.76–3.78 Mev doublet has spin $(^3/_2,^5/_2)^+$. The transition to the 3.76-Mev state agrees well with an l = 3 pattern. Also, the l = 0 transition was shown to belong to the 3.47-Mev level of the 3.47–3.48 Mev doublet. Energies, orbital angular momenta (l), and mass-3 form factors for the levels are included. (D.C.W.)

16919 (ANL-6848(p.108-13)) PARTICLE-HOLE CALCULATION OF $Ca^{40}(\alpha,\alpha')$. Nathan S. Wall (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). (TID-20182)

The inelastic scattering of alpha particles to 3^- states of Ca^{40} was calculated in the distorted-wave Born approximation using particle-hole wave functions. The form factors and angular distributions for the first three 3^- states are displayed and discussed. The results and analysis of some recent experiments are briefly considered. (D.C.W.)

16920 (ANL-6848(p.114-17)) ANALYSIS OF ELASTIC SCATTERING OF 17-Mev PROTONS FROM HEAVY NUCLEI. F. G. Perey (Oak Ridge National Lab., Tenn.).

The elastic scattering of 17-Mev protons by Ta, W, Pb, Bi, Pt, and Au was satisfactorily calculated, using a single set of optical-model parameters obtained from fitting the Bi and Pb data, by taking into account the permanent quadrupole deformations of the outer nuclei by a coupled-channel calculation. (D.C.W.)

16921 (ANL-6848(p.118-22)) THE PARITY RULE FOR INELASTIC SCATTERING AT SMALL ANGLES. I. E. McCarthy (California. Univ., Davis).

The parity rule is explained and verified and is compared with the Blair phase rule, which is also used to determine parities from inelastic scattering. (D.C.W.)

16922 (ANL-6848(p.123-4)) THE DEUTERON-GAMMA ANGULAR CORRELATION IN THE REACTION $Mg^{24}(d,d'\gamma)Mg^{24}$ + (1.37 Mev) AT 11.8 Mev. V. Jung and U. Schmidt-Rohr (Max-Planck-Institut für Kernphysik, Heidelberg).

The angular distribution of inelastically scattered deuterons from the reaction $Mg^{24}(d,d'\gamma)Mg^{24}$ leading to the first excited state of Mg^{24}(1.37 Mev) was measured in coincidence with the gamma rays on the normal of the reaction plane. The gamma rays were detected with a NaI crystal–the deuterons with a CsI crystal. The distribution shows a marked structure. From comparison with correlation distributions calculated for inelastic proton scattering by Mg^{24}, it is concluded that the probability for spin-flip in inelastic deuteron scattering is not very large. (D.C.W.)

16923 (ANL-6848(p.125-9)) EXCITATION OF T = T_z + 2 STATES. G. T. Garvey (Princeton Univ., N. J.).

The excitation of states with $T = T_z + 2$ units of isobaric spin by (p,t) reactions in which the T_z of the target is $>^1/_2$ and $T_i = T_z$ is considered. Apparently, only two-neutron pickup reactions can excite such states in a first-order process. It is shown that although the states may have rather high excitation energies, they are probably not particle unstable. Excitation energies and spectroscopic factors for the lowest $T = T_z + 2 = T_i + 1$ states in even-even nuclei ($20 \leq Z, N \leq 28$) were estimated. The spectroscopic factor for the $T = T_i + 1$ state is sufficiently greater than that of adjacent states to make the state detectable. (D.C.W.)

16924 (ANL-6848(p.130-6)) ANALYSIS OF ELASTIC AND INELASTIC SCATTERING OF 40 Mev PROTONS. Martin P. Fricke (Minnesota. Univ., Minneapolis).

Angular distributions for the elastic scattering of 40-Mev protons from Fe^{54}, Fe^{56}, Ni^{58}, Ni^{60}, and Pb^{208} were analyzed in terms of an optical model potential. Both surface and volume forms of the imaginary central potential described the data with equal success. Inelastic scattering by the nuclei was then calculated in distorted-wave Born approximation assuming collective excitations to 2^+ and 3^- states, and transition strengths were obtained by comparison with the data. Polarization in scattering by Ni was also calculated by the optical model on the basis of the elastic cross section data. Typical fits are shown; and optical-model parameters, calculated elastic cross sections, and angular momenta and deformabilities determined from the inelastic scattering are tabulated. (D.C.W.)

16925 (ANL-6848(p.137-42)) SPECTROSCOPIC DATA DEDUCED FROM INELASTIC SCATTERING OF 44-Mev ALPHA PARTICLES IN MEDIUM-WEIGHT NUCLEI. H. Faraggi and J. Saudinos (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay).

The spins, parities, and reduced radiative widths B(El) of excited states in Fe^{54}, Fe^{56}, Fe^{58}, Ni^{58}, Ni^{60}, Ni^{62}, Ni^{64}, Zn^{64}, Zn^{66}, and Zn^{68} were obtained from inelastic alpha scattering data, assuming the validity of the Drozdov inelastic diffractional model. The Blair phase rules were also used in interpretation of the data. The B(El) values obtained by this analysis are in satisfactory agreement with values obtained from Coulomb excitation or inelastic electron scattering. The levels are discussed in terms of excitation modes and the Blair phase rule. The results show that the prediction of the two-phonon model for phase reversal is not verified overall. (D.C.W.)

16926 (ANL-6848(p.143-6)) ISOBARIC ANALOGUE STATES AND INTERMEDIATE RESONANCES IN NUCLEI. S. Fallieros (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science).

The appearance of resonances at incident proton energies corresponding to the excitation of the isobaric-analogue states in the compound system is discussed in terms of the pure shell model. The analogue in Y^{89} of the ground state of Sr^{89} is treated as an illustration. A three-quasi-particle interpretation of the resonances is favored. (D.C.W.)

16927 (ANL-6848(p.147-52)) ANGULAR MOMENTUM SELECTION AND ANGULAR CORRELATIONS IN DIRECT REACTIONS WITH STRONGLY ABSORBED PARTICLES.

J. G. Wills and J. G. Cramer, Jr. (Indiana Univ., Bloomington).

The strange behavior of the correlation symmetry angle for alpha inelastic scattering is shown to result from the contribution of only a few angular momenta to the scattering amplitude. Calculations were made for l = L − 2, L, and L + 2, assuming that only one incoming momentum, L, and one outgoing angular momentum, l, participate in the inelastic scattering. (D.C.W.)

16928 (ANL-6848(p.153-8)) ANGULAR-CORRELATION STUDIES OF THE INELASTIC SCATTERING OF ALPHA PARTICLES FROM C^{12}, Mg^{24}, Si^{28}, AND Fe^{56}. J. G. Cramer, Jr., W. W. Eidson, and D. E. Blatchley (Indiana Univ., Bloomington).

The alpha-gamma angular correlations in $(\alpha,\alpha'\gamma)$ reactions on C^{12}, Mg^{24}, Si^{28}, and Fe^{56} at 22.5 Mev were measured at several scattering angles. The correlation functions were determined at each angle by measuring the coincidence gamma yield at several gamma detection angles. Plots of the symmetry angles of the correlation functions vs the scattered alpha center-of-mass angles, together with the predictions of adiabatic theory, show strong correlation between the cross section minima and the sweeps of the symmetry angle. Evidence for a sizable incoming angular momentum-outgoing angular momentum contribution to the scattering amplitudes of the reaction is also observed. A distorted-wave Born approximation fit to the Si^{28} data was also obtained. (D.C.W.)

16929 (ANL-6848(p.160-7)) NEUTRON REDUCED WIDTHS DETERMINED BY THE $N^{14}(N^{14},N^{13})N^{15}$ TRANSFER REACTION. J. A. McIntyre (Texas. Agricultural and Mechanical Univ., College Station).

The angular distribution of the N^{13} nucleus in the $N^{14}(N^{14},N^{13})N^{15}$ reaction at 6.15 Mev was previously measured and was calculated quite well by the tunneling theory. The total cross section for neutron transfer was also measured, verifying its energy dependence, and was calculated by tunneling theory. At energies between 5.5 and 6.5 Mev, the theory described the data quite well. A single-particle reduced width obtained from the total cross section was significantly larger than those obtained by (d,p) analysis or shell model calculation. (D.C.W.)

16930 (ANL-6848(p.168-71)) SELECTION RULES IN $_{22}Ti^{48}_{26}(p,p')$ INELASTIC SCATTERING. G. T. Garvey, G. M. Crawley, H. O. Funsten, N. R. Roberson, and L. Zamick (Princeton Univ., N. J. Palmer Physical Lab.).

The bases and predictions of the selection rules for scattering to the J = 2, 4, or 6 levels of Ti^{48} are discussed in terms of a shell model configuration, assuming that the scattering process involves direct reaction. Experiments that seem to verify the rules are described, and the adequacy of the shell and vibrational models to explain the observed excitation inhibitions are discussed. (D.C.W.)

16931 (ANL-6848(p.177)) NUCLEON CAPTURE REACTIONS NEAR A = 40. J. L. Yntema (Argonne National Lab., Ill.), and G. R. Satchler (Oak Ridge National Lab., Tenn.).

Angular distributions for several transitions in (d,He^3) reactions on Ca^{40}, Ti^{46}, Ti^{47}, Ti^{48}, Ti^{49}, and Ti^{50} were obtained and analyzed by distorted-wave theory. Spectroscopic factors were determined by comparing the calculated and measured differential cross sections. The results show that the excitation energies of the $d_{3/2}$ and $s_{1/2}$ hole states are surprisingly low and increase with the number of $f_{7/2}$ neutrons in the nucleus. (D.C.W.)

16932 (ANL-6848(p.180-1)) THE SINGLET DI-NUCLEON STATE IN NUCLEAR REACTIONS. G. M. Temmer (Rutgers Univ., New Brunswick, N. J.).

The possibility of singlet-state deuteron pickup is being investigated for $C^{13}(p,d^*)C^{12*}$. The breakup neutrons which, like the protons, carry half the outgoing di-nucleon energy should be detectable at 0°. Time-of-flight spectra for $C^{13}(p,n)N^{13}$ revealed an unexplained peak at 0°, but not at 40°. The position of the half-energy neutron peak from singlet deuteron breakup was calculated to be 2.82 Mev. The observed width is about 500 kev, and the cross section is about 3 mb/sterad. Breakup protons are being sought. (D.C.W.)

16933 (ANL-6848(p.182-7)) THE FORMATION OF STRONGLY POPULATED LEVELS OF $(d_{5/2})^2_{5^+}$ AND $(f_{7/2})^2_{7^+}$ CONFIGURATION IN THE (α,d) REACTION. B. G. Harvey, E. Rivet, J. Cerny, R. H. Pehl, and J. Haag (California. Univ., Berkeley. Dept. of Chemistry and California. Univ., Berkeley. Lawrence Radiation Lab.).

The angular distributions and energy spectra of deuterons from the (α,d) reaction on C^{12}, Ne^{20}, Mg^{24}, Ar^{40}, and Ca^{40} at 45 or 50 Mev were measured. At least one, and in some cases two, levels of the product nucleus were very highly populated. The configurations were identified as $(d_{5/2})^2$ or $(f_{7/2})^2$ with spins and parities of 5+ or 7+ respectively. The Q values for excitation of the highly populated levels are included. (D.C.W.)

16934 (ANL-6848(p.188-98)) ANALYSIS OF TWO-NUCLEON STRIPPING REACTIONS. Norman K. Glendenning (California. Univ., Berkeley. Lawrence Radiation Lab.).

A method for obtaining information on two-nucleon stripping reactions from nuclear wave functions is described and demonstrated using $C^{12}(\alpha,d)N^{14}$ as an example. The structure factors for the wave functions are constructed, and the implications of the level intensities given by the wave functions are derived from experimental data. (D.C.W.)

16935 (ANL-6848(p.199-207)) THE STUDY OF (He^3,n) REACTIONS. G. U. Din, J. L. Weil, and G. C. Phillips (Rice Univ., Houston, Tex.).

Excitation curves and neutron angular distributions for (He^3,n) reactions at 1.5 to 5.5 Mev on Li^7, Be^9, B^{11}, C^{12}, C^{13} and O^{18} were measured. For Be^9 and O^{18}, neutron groups leading to the ground and first excited states of the residual nuclei were studied. For the other nuclei, only the neutron groups leading to the ground state were investigated. Total cross sections for Be^9, B^{11}, C^{12}, and C^{13} were also obtained. Evidence for a direct interaction mechanism was observed. (D.C.W.)

16936 (ANL-6848(p.208-16)) THE (p,t), (p,He^3), AND (p,α) REACTIONS ON O^{16} INDUCED BY 43.7-Mev PROTONS. Joseph Cerny and Richard H. Pehl (California. Univ., Berkeley. Dept. of Chemistry and California. Univ., Berkeley., Berkeley. Lawrence Radiation Lab.).

Energy spectra from the (p,t), (p,He^3), and (p,α) reactions on O^{16} at 43.7 Mev were measured. The angular distributions for the population of the O^{14} ground state and the N^{14} 2.31-Mev level (analog states), as well as the N^{14} ground state were fitted by a two-nucleon-transfer DWBA calculation. Consideration of the final states populated supports a pickup mechanism for the reaction. (D.C.W.)

16937 (ANL-6848(p.226)) ANALYSIS OF THE $C^{13}(\alpha,n)O^{16}$ REACTION AT INTERMEDIATE ENERGIES. J. W. McRary, J. Y. Park (North Carolina State Coll.,

Raleigh); G. D. Thaxton, and E. Merzbacher (North Carolina. Univ., Chapel Hill).

The theory of direct knockout reactions was applied to the $C^{13}(\alpha,n)O^{16}$ reaction at 12.8, 14.1, and 22.5 Mev. DWBA calculations were made using both a finite-range and zero-range interaction. Nuclear optical potentials including Coulomb and spin-orbit terms were assumed. Both oscillator and square-well eigenfunctions were examined as possible phenomenological solutions to the spectroscopic problem of neutron and alpha wave functions. The calculated differential cross sections were in reasonable agreement with data. Theoretical polarizations were also obtained. Within the limits of inexact optical parameters, it was concluded that the reaction proceeds mainly by a knockout process at these energies. (auth)

16938 (ANL-6848(p.228-9)) DIRECT REACTION CONTRIBUTIONS TO FLUCTUATING REACTION CROSS SECTIONS. G. M. Temmer, B. Teitelman, and F. G. Fender (Rutgers Univ., New Brunswick, N. J.).

Excitation curves for several (p,α) reactions at various angles and energies and to several residual states were analyzed using the theories of Ericson and Stephen. At an excitation near 20 Mev and at 90°, the probability distribution of fluctuations about the average cross sections were obtained surprisingly well by the theory without direct-reaction amplitude. The strong dependence on the number of degrees of freedom (N) was clearly demonstrated between N = 2 and 72 using nuclei between N^{15} and Co^{59}. The sensitivity to the admixture of a nonfluctuating component was computed for all N. (auth)

16939 (ANL-6848(p.236-9)) AN ESTIMATION OF PION NUCLEAR ELASTIC CHARGE-EXCHANGE SCATTERING. R. K. Kerman and R. K. Logan (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science).

An optical model potential including elastic charge-exchange scattering in which the nucleus is scattered to various states of a single isotopic multiplet was constructed. The double charge-exchange cross section was calculated without including Coulomb corrections. (D.C.W.)

16940 (ANL-6848(p.24-9)) ANALYSIS OF THE SCATTERING OF PROTONS BY Ho^{165} IN TERMS OF THE COUPLED-CHANNEL CALCULATION. Taro Tamura (Oak Ridge National Lab., Tenn.).

The excitation of levels in Ho^{165} by elastic and inelastic scattering of protons at 17.5 Mev was analyzed by the coupled-channel approach. The formulation for spin-$\frac{1}{2}$ particles is outlined. The coupling of the $\frac{7}{2}^-$, $\frac{9}{2}^-$, and $\frac{11}{2}^-$ levels was considered. The angular distribution obtained is in quite good agreement with experiment. (D.C.W.)

16941 (ANL-6848(p.241-8)) THEORY OF INTERMEDIATE STRUCTURE. J. E. Young (Los Alamos Scientific Lab., N. Mex.).

The appearance of intermediate resonance structure due to degeneration of two particle-one hole states is explained on the basis of the many-body formulation of elastic scattering. (D.C.W.)

16942 (IDO-16954) DOPPLER BROADENING OF THE TOTAL, FISSION, CAPTURE, AND SCATTERING NEUTRON CROSS SECTIONS OF Pu-241. N. H. Marshall and O. D. Simpson (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Dec. 16, 1963. Contract AT(10-1)-205. 58p.

The cross sections were calculated by the Reich-Moore multilevel formula from 0.02 to 11 ev and were convoluted with Doppler functions corresponding to various sample temperatures. The cross sections are tabulated vs neutron energy for temperatures of 27, 500, 1000, 2000, and 3000°C. (D.C.W.)

16943 (IS-676) PHOTONEUTRON RESONANCES IN OXYGEN-16. James Edward Griffin and Charles L. Hammer (Ames Lab., Ames, Iowa). Feb. 1963. Contract W-4705-eng-82. 105p.

The cross section for the reaction $O^{16}(\gamma,n)O^{15}$ has been determined from threshold energy to 60 Mev using bremsstrahlung from the Iowa State University synchrotron. The O^{15} radioactivity yield curve was measured and the relative cross section extracted using least structure analysis. The data were corrected for multiple neutron processes and extraneous activities. The problem of cross section extraction from a yield curve is described and the resulting integral equation is presented in matrix form. Several methods of solution are discussed and the least structure method is described in detail. A limited description of the experimental apparatus is presented with a more detailed discussion of the synchrotron energy control system. Resonances in the $O^{16}(\gamma,n)O^{15}$ cross section are observed at 17.4, 19.3, 22.4, 24.5, 32.7, 38.9, 45.1, 50.4, and 57.9 Mev with additional poorly resolved resonances at 21.0, 26.5, and 28.4 Mev. The results are compared with those of other experiments and with existing theories. Such comparisons indicate that the 19.3 Mev resonance and those resonances between 26 Mev and 40 Mev result from E2 interactions. Remaining resonances in the giant resonance region are believed to be E1 and the resonances at 45.1 and 50.4 Mev appear to be E1 overtones. The cross section integrated from 30 to 60 Mev appears to be about 40 percent of the cross section integrated from threshold energy to 30 Mev. (auth)

16944 (LAL-1091) DIFFUSION INELASTIQUE D'ELECTRONS DE HAUTE ENERGIE SUR L'ALUMINIUM 27. (Inelastic Scattering of High-Energy Electrons on Aluminum-27). J. Chollet, P. Bounin, and G. R. Bishop (Paris. Université, Orsay. École Normale Supérieure. Laboratoire de l'Accélerateur Lineaire). Jan. 1964. 95p.

The quasielastic scattering of electrons on aluminum was studied. The spectra of electrons scattered at 70, 94, 120, 140, 160, 180, and 200 Mev were measured, and the effective scattering cross section was obtained by two techniques. Interpretation of the spectra by the shell model and impulse approximation was attempted. (D.C.W.)

16945 (NP-13601) ISSLEDOVANIE UROVNEI YADER KHLORA-35 I KALIYA-41 (dissertatsiya). (Investigation of the Energy Levels of the Nuclei of Cl^{35} and K^{41} (thesis)). A. N. L'vov (Akademiya Nauk Ukr. S.S.R. Fiziko-Technicheskii Institut, Karkov). 1962. 134p.

Energy levels and decay schemes for Cl^{35} and K^{41} were investigated using a proton capture method. A short review is given of published data on the levels of the nuclei. The conclusions from (p,γ) reactions and one-particle radiative transitions are discussed, and experimental techniques and data are analyzed. The ground state spins and parities, equilibrium shapes, nuclear moments, and characteristics of Ar^{35} β decay indicate qualitative agreement with model calculations. It is shown that most of the Cl^{35} and K^{41} levels can be well described by the Nilson scheme, using one-particle excitation. The most probable level spins and parities were determined on the basis of angular distribution. (R.V.J.)

16946 (NP-13654) KANALOVYE EFFEKTY V ENERGETICHESKOI ZAVISIMOSTI CHISLA MGNOVENNYKH NEITRONOV I KINETICHESKOI ENERGII OSKOLKOV PRI DELENII URANA-235 I URANA-233 NEITRONAMI. (Channel Effects in Energy Dependence of the Number of Prompt

Neutrons and the Kinetic Energy of Fragments in Neutron-Induced Fission of Uranium-235 and Uranium-233). Yu. A. Blyumkina, I. I. Bondarenko, V. F. Kuznetsov, V. G. Nesterov, V. N. Okolovich, G. N. Smirenkin, and L. N. Usachev (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1962. 43p.

Effects of discrete fission-channel structure on the mean kinetic energy of E_k fractions and the mean number of prompt neutrons $\bar{\nu}$ are investigated. Measurements were made of $\bar{E}_k$ and $\bar{\nu}$ as functions of fission-inducing neutron energy E_n. The results showed that there are many deviations from the accepted hypothesis of $\bar{E}_k$ independence from E_n and from the hypothesis on linear $\bar{\nu}$ growth with increased E_n. The formerly predicted concepts of the above effects show that they have an inverse term. Fission processes of U^{233} and U^{235} are discussed. (tr-auth)

16947 (NP-13661) GRUPPOVYE SECHENIYA NEKOTORYKH YADERNYKH REAKTSII ISPOL'ZUYUSHCHIKHSYA DLYA REGISTRATSII NEITRONOV. (Group Cross Sections of Certain Nuclear Reactions Used for Recording Neutrons). V. I. Golubev, M. N. Nikolaev, and Yu. M. Orlov (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 23p.

A twenty-five group cross section table is given for Au^{197}, In^{115}, I^{127}, Mn^{55}, Na^{23}, Cu^{63}, and $Cu^{65}(n,\gamma)$, $P^{31}(n,p)$, and $Np^{237}(n,f)$ reactions. A short description is also given of methods for determining the cross sections. (R.V.J.)

16948 (NP-13732) CONTRIBUTION A L'ÉTUDE DE LA RÉACTION: $C^{13}(He^3,\alpha)C^{12}$ ENTRE 1 ET 2 Mev (THÈSES). (Contribution to the Study of the Reaction $C^{13}(He^3,\alpha)C^{12}$ Between 1 and 2 Mev (Thesis)). Jean Schmouker (Paris. Université). 1960. 59p.

The angular distribution of α_0 from the reaction $C^{13}(He^3,\alpha)C^{12}$ for a He^3 energy of 1.8 Mev and the cross section of the reaction for He^3 energies between 1 and 2 Mev were measured experimentally. The form of the angular distribution is not symmetric with respect to 90°. It has a strong rise toward the rear, not very compatible with a "pick-up" hypothesis. The cross section increases with energy, but it has no resonance. This deviates from formation by compound nucleus. Calculations made using a pick-up process gave theoretical curves incompatible with the experimental points found. A theory which considers the reaction as a mixture of neutron pick-up and stripping of an α particle out of the target nucleus with absorption of the He^3 particle by this nucleus gives more probable results. The agreement is not perfect, but the experimental results are approached. (tr-auth)

16949 (NP-13735) CONTRIBUTION À L'ÉTUDE DES DÉFORMATIONS QUADRUPOLAIRES DES NOYAUX LOURDS (theses). (Contribution to the Study of the Quadrupolar Deformations of Heavy Nuclei (thesis)). Roger Foucher (Paris. Université). [1967]. 93p.

The quadrupolar deformation of heavy nuclei was studied experimentally. The theoretical aspects of deformation of nuclei and probability of γ transition, together with angular correlations and internal conversion, are discussed. The methods used for the analysis of α, β, and γ radiation and for the measurement of the mean lifetime of excited states are described. The mean lifetimes of the 2+ and 4+ levels of Ra^{226}, 2+ level of Ra^{224}, and 2+ level of Rn^{222} were measured. The results show that the lifetimes and the attenuation of the α-γ angular correlations are explained by the Bohr-Mottelson theory of rotational levels conjugated with the Abragam-Pound theory of angular correlation perturbations. The parameters of quadrupolar deformation were deduced for U^{234}, Ra^{226}, Ra^{224}, Rn^{222}, and Rn^{220}. The transitions between the deformed nuclei and the spherical nuclei of lower mass are not as slow as had been assumed. The character of the transition between spherical nuclei and deformed nuclei was shown to be true for Ra^{223}. The electric quadrupole moment of the first level, the mean lifetime of the 286-kev level, and the probabilities of partial emission of the 236-kev γ radiation are given for this nucleus. Definitive conclusions could not be obtained on the quadrupolar deformation of Ac^{227} and Pa^{234}. The probabilities of γ transition (M_2) and the internal conversion coefficients (M_1) are discussed. (J.S.R.)

16950 (SGAE-PH-2/1964) THE USE OF ELECTROMAGNETIC MASS-SEPARATION FOR CROSS SECTION MEASUREMENTS IN CONTINENTAL EUROPE. P. Weinzierl and F. P. Viehboeck (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Vienna). Jan. 1964. 15p.

Electromagnetic mass separation may be used in studies of nuclear reaction yields and cross sections. The design aspects of the mass separators of continental Europe pertinent to such studies are reviewed, and the causes of material losses are discussed. Some of the studies made with the mass separators are described briefly. The preparation of isotopic targets are considered. (D.L.C.)

16951 (TID-20311) CYCLOTRON RESEARCH ANNUAL PROGRESS REPORT FOR YEAR ENDING JUNE 15, 1963. (Washington. Univ., Seattle. Nuclear Physics Lab.). Contract AT(45-1)-1388. 54p.

Progress is reported on beta and gamma spectroscopy, nuclear scattering studies and correlations of scattered particles with gamma rays, nuclear fission studies, investigations of compound nuclear reactions, studies of miscellaneous nuclear reactors, accelerator research and development, and development of instrumentation for research. (M.C.G.)

16952 (TID-20313) STIMULATED EMISSION OF GAMMA RADIATION. R. V. Babcock, S. L. Ruby, and L. M. Epstein (Westinghouse Electric Corp. Research Labs., Pittsburgh). Dec. 1963. Contract AT(30-1)-3011. 79p. (WERL-63-927-115-R1)

The feasibility of an experimental demonstration of stimulated emission of gamma radiation is examined. Theoretical principles are discussed, and a model described from which the results of stimulated emission experiments can be predicted. Two general types of experiments are selected as most feasible for the demonstration, and the results of these experiments are predicted for those known isomeric nuclear systems that appeared most promising, and also for an ideal nuclear system. It is concluded that for an ideal nucleus the emission rate of stimulated photons could not exceed 10^{-5} of the spontaneous photon emission rate. For the most favorable nuclear system found, the predicted increase in emission rate is only 3×10^{-9}. The observation of such small effects appears thoroughly impractical, either now or in the foreseeable future. The observation of other effects of stimulated emission, such as the detection of paired photons in time coincidence, appears equally difficult. (auth)

16953 (TID-20352) SUMMARY OF PROGRESS REPORT [ON NUCLEON-NUCLEON INTERACTION] PERIOD ENDING, FEBRUARY 1964. McAllister H. Hull, Jr., and Gregory Breit (Yale Univ., New Haven). Mar. 1964. Contract AT(30-1)-1807. 12p.

Research progress on N-N interactions, π-N interactions, nucleon-nucleus scattering, deuteron photodisinte-

gration, heavy ion reactions and scattering, and higher order effects in Coulomb excitation is summarized. (D.C.W.)

16954 (UCRL-11143) POLARIZATION OF SILVER NUCLEI IN FERROMAGNETS AND THE INTERNAL MAGNETIC FIELD (thesis). Gene A. Westenbarger (California. Univ., Berkeley. Dept. of Chemistry and California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 21, 1963. Contract W-7405-eng-48. 101p.

The signs and magnitudes of the hyperfine-structure constants of two silver isotopes dissolved in the ferromagnetic metals iron and nickel were determined. The silver nuclei were polarized by application of a small magnetic field to alloys that had been cooled to about 0.01°K. Thermometry was performed by measurement of the polarization of Co^{60} in the alloy. Spatial anisotropies of both beta and gamma rays from Ag^{104} and Ag^{110m} were measured. Parity was shown not to be conserved in the allowed beta decay of these isotopes. Spin assignments were made or confirmed for several excited states in Cd^{110}. The M1-E2 mixing ratios were determined for the 1384 and 1504-kev γ rays following the decay of polarized Ag^{110m}. The products of the nuclear magnetic moment of Ag^{110m} and the internal magnetic fields at the nuclei of silver dissolved in iron and nickel were found to be negative and equal to $-(9.0 \pm 0.5) \times 10^5$ nm-gauss for Ag^{110m} in iron and $-(3.5 \pm 0.3) \times 10^5$ nm-gauss in nickel. The role of conduction-electron polarization in the production of internal magnetic fields in ferromagnetic metals is discussed. 56 references. (auth)

16955 (ZFK-TPH-1) F-BERECHNUNG MIT TRANSPORTAPPROXIMATION. (f-Calculation with Transport Theory). H.-U. Barz (Germany. Zentralinstitut für Kernphysik, Dresden). Aug. 1960. 12p.

Calculation of the thermal utilization, f, defined as the fraction of the thermal neutrons absorbed in uranium per total absorption, using the transport theory is discussed. (M.C.G.)

16956 (ZFK-TPH-7) DIE S-WELLEN-NEUTRONEN-STÄRKEFUNKTION BEI NICHTAXIALSYMMETRISCH DEFORMIERTEN KERNEN. (The S-Wave-Neutron Strength Function in Non Symmetric Deformed Nuclei). Roland Reif (Germany. Zentralinstitut für Kernphysik, Dresden). Aug. 1961. 31p.

The theory of Davydov-Filipov suggests the use of a non-axially deformed complex potential in calculations with the phenomenological optical model. Experimental data show that deviations from the axial symmetry of deformation lead to measurable effects in the s-wave neutron strength-function. In order to estimate the influence of nonaxiality on the strength function, the scattering problem of slow neutrons by a nonaxially deformed square well potential is solved in the adiabatic approximation. The conditions of fitting the wavefunction and its gradient at the edge of the nucleus give a linear system of equations for the determination of the s-wave scattering amplitude by means of which the strength-function is expressed. (auth)

16957 (AEC-tr-6371) EMISSION OF NEUTRONS ON RUPTURE OF THE URANIUM NUCLEUS. A POSSIBLE CHAIN REACTION. Charles Haenny and Albert Rosenberg. Translated from Compt. Rend., 208: 898-900(1939). 5p.

A hexane ionization chamber was used to study the emission of neutrons in the rupture of uranium nuclei. Using a 10 mC source (Rn + Be) surrounded by 8 cm of U_3O_8, a 20% increase in the effect produced by neutrons in the ionization chamber was observed instead of a 5% decrease predicted by a capture cross section of 5×10^{-5} cm^2. This effect provides a means for increasing the intensity of weak sources for readily obtainable large laboratory sources. (L.B.S.)

16958 (NP-tr-1114) MEASUREMENT OF THE CROSS SECTIONS OF INELASTIC NEUTRON COLLISIONS WITH Fe, Ni AND Nb NUCLEI AT NEUTRON ENERGIES FROM 0.6 TO 2.4 Mev. A. I. Abramov and M. G. Yutkin. Translated by D. L. Allan (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from Yadern. Reaktsii pri Malykh i Srednikh Energ., Akad. Nauk SSSR, Tr. Vtoroi Veses. Konf., Moscow, 1960(Pub. 1962). 23p.

The inelastic scattering cross sections were determined by the transmission method using an inverse spherical geometry. The total inelastic cross sections for Fe, Ni, and Nb were obtained, together with the partial cross sections for the excitation of two groups of levels in Nb. The results are discussed and are compared with other determinations and theory when comparison is meaningful. (D.C.W.)

16959 EXCITATION OF NUCLEAR ROTATIONAL LEVELS BY SCATTERING OF HIGH-ENERGY NUCLEONS. M. Sotona (Inst. of Nuclear Physics, Czchoslovak Academy of Sciences, Rez). Czech. J. Phys., 13: 871-80(1963). (In Russian)

The excitation of rotational levels of nuclei by scattering of high-energy nucleons is considered. The general formula for cross section is obtained. The cross section dependence of excitation of first two rotational levels of even-even nuclei on nuclear deformation parameter is given for three values of the parameter a, which characterizes absorption of nucleons by nuclear matter. (auth)

16960 ON THE CONTRIBUTION OF ANOMALOUS DIAGRAMS TO THE GROUND-STATE ENERGY OF NUCLEAR MATTER. J. Tolar (Czech. Tech. Univ., Prague). Czech. J. Phys., 14: 1-4(1964).

It is shown that spin-orbit two-nucleon interaction does not lead to anomalous contributions to the Brueckner-Goldstone perturbation series in the second approximation. (auth)

16961 THE HALF-LIFE OF CARBON-14: COMMENTS ON THE MASS-SPECTROMETRIC METHOD. E. E. Hughes and W. B. Mann (National Bureau of Standards, Washington, D. C.). Intern. J. Appl. Radiation Isotopes, 15: 97-100 (Mar. 1964).

As assessment was made of the mass-spectrometer results in the recent NBS determination of the half life of carbon-14. Evidence is presented to show that the uncertainties due to effusive separation and the dependence of the sensitivity constant on the isotopic abundance of carbon-14 are small. It is proposed, however, to reduce the value of the half life of carbon-14 determined as 5745 ± 50 years. (auth)

16962 ON CALCULATIONS OF SPACE DISTRIBUTION OF DOSE STREAMS OF CAPTURE γ RADIATION. L. P. Bokacheva, K. K. Popkov, and L. N. Tabolina. Inzh. Fiz. Zh., Akad. Nauk Belorussk. SSR, 6: No. 11, 85-9(Nov. 1963). (In Russian)

A simplified method to find distribution of capture γ-radiation streams, which is based on the notion of a build-up factor and data on build-up factors for a case of a point isotopic monopower source in an infinite medium is described. The plots of dose stream distributions of capture γ-radiation from iron, nickel, chromium, and water are

presented that make it possible to fulfill calculations with the accuracy sufficient for practical purposes. (auth)

16963 RECENT EXPERIMENTAL RESULTS IN THE PHYSICS OF HYPERFRAGMENTS. J. Sacton (Université Libre, Brussels). J. Phys. (Paris), 24: 784-91(Nov. 1963). (In French)

Experimental studies of the binding energies and lifetimes of Λ-hyperon-containing hypernuclei having Z = 1 to 7 are reviewed. The detection of a double hyperfragment is reported. (T.F.H.)

16964 INTERACTION OF 14.1-Mev NEUTRONS WITH DEUTERIUM. Gilbert Vedrenne, Daniel Blanc, and Francis Cambou (Faculté des Sciences, Toulouse). J. Phys. (Paris), 24: 801-3(Nov. 1963). (In French)

A method is described for obtaining the distribution of neutrons elastically scattered by deuterium from the spectrum of recoil deuterons produced in a "deuterated" benzene scintillator. In order to make an approach to the inelastic scattering, a time-of-flight method is applied, utilizing as reference the results obtained for elastic scattering. (auth)

16965 ANGULAR DISTRIBUTION OF TRITONS EMITTED IN THE REACTION ^{6}Li(n,t)^{4}He. Y. Baudinet-Robinet, E. Donneaux, G. Robaye, and L. Winand (Université, Liege). J. Phys. (Paris), 24: 803-4(Nov. 1963). (In French)

The angular distribution of tritons emitted in the ^{6}Li(n,t)^{4}He reaction is measured for E_n = 190 kev. The tritons are detected with photographic plates placed around the ^{6}Li target. The angular distribution obtained is not symmetric backward-forward. (auth)

16966 DETERMINATION OF THE INELASTIC COLLISION CROSS SECTION OF BERYLLIUM AT 14.2 Mev. D. Didier and H. Dillemann (Commissariat à l'Énergie Atomique, [Paris]. J. Phys. (Paris), 24: 805-8(Nov. 1963). (In French)

The nonelastic cross section of beryllium for 14.2-Mev neutrons has been measured using the sphere transmission technique. Corrections have been applied to the data, principally for multiple scattering and energy loss of neutrons in elastic collisions. The result is $\sigma_{ne} = 0.50 \pm 0.01$ barn. (auth)

16967 EXCITATION OF THE LEVEL AT 7.65 Mev IN ^{12}C BY INELASTIC SCATTERING OF 14-Mev NEUTRONS. R. Bouchez, J. Duclos, F. Merchez, P. Perrin, and I. Szabo (Université, Grenoble, France and CEA-CENG [Grenoble, France]. J. Phys. (Paris), 24: 809-10(Nov. 1963). (In French)

The angular distribution for inelastic scattering of 14-Mev neutrons on the 7.65-Mev level (0^+) from ^{12}C has been measured. The experimental differential cross section of about 10 mb/sr at 0 = 10° decreases rapidly and gives a minimum at about θ = 45°. (auth)

16968 SCATTERING OF 14-Mev NEUTRONS BY CARBON-12: EXCITED STATES AT 4.43, 7.66, 9.6, AND 10.1 Mev. J. Roturier, Pham Khac Ham, M. Buret, and G. Y. Petit (Faculté des Sciences, Bordeaux). J. Phys. (Paris), 24: 811-13(Nov. 1963). (In French)

A study of inelastic scattering by 14-Mev neutrons on a ^{12}C target by a time-of-flight method gave the differential cross section for the levels at 4.43, 7.66, 9.6, and 10.1 Mev. The dependence on angle seems, at least for the first and second levels, to favor a direct interaction. (auth)

16969 CROSS SECTIONS FOR (n,p), (n,α) AND (n,2n) ON ^{19}F AND ^{23}Na BETWEEN 13 AND 21 Mev. J. Picard and C. Williamson (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 813-15(Nov. 1963). (In French)

The cross sections for these reactions have been measured in the neutron energy range 13 to 21 Mev by the activation method. The results are compared with the predictions of the statistical theory. (auth)

16970 DETERMINATION OF NEUTRON CROSS SECTIONS. J. M. F. Jeronymo, G. S. Mani, J. Olkowsky, A. Sadeghi, and C. Williamson (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 816-18(Nov. 1963). (In French)

Reaction cross sections of the type (n,p), (n,d), (n,t), and (n,α) for ^{24}Mg, ^{27}Al, ^{28}Si, ^{58}Ni, and ^{59}Co nuclei have been measured with neutrons of energy from 12.5 to 21 Mev. The efficiency of the well-crystal used has been measured. (auth)

16971 FLUCTUATION OF THE CROSS SECTION OF THE (n,α) REACTION ON NATURAL SILICON BETWEEN 13.6 AND 15 Mev. E. Fort and P. Thouvenin (Commissariat à l'Énergie Atomique, [Paris]). J. Phys. (Paris), 24: 819-22(Nov. 1963). (In French)

The fluctuation of cross sections, relative to the first excited states of ^{25}Mg and ^{26}Mg, is described as the energy of the neutrons varies from 13.6 to 15 Mev. The original element in this contribution relates to the ground state and the first state of ^{26}Mg. (auth)

16972 INELASTIC SCATTERING OF 14.1-Mev NEUTRONS BY SULFUR-32. G. Souchere, S. Harar, B. Fernandez, J. Picard, and M. Conjeaud (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 822-5 (Nov. 1963). (In French)

14.5-Mev neutrons have been scattered by ^{32}S. Angular distributions have been measured for inelastic scattering (Q = 0, Q = −2.24 Mev, and Q = −4 to −5 Mev), by the time-of-flight method with the associated particle. The results are compared with the theoretical predictions for transition $0^+ \rightarrow 2^+$, E ~ 2 Mev, A ~ 30. The experimental curves Q = −2.24 Mev and ~ = −4 to −5 Mev are very similar. (auth)

16973 DETERMINATION OF THE TOTAL CROSS SECTIONS OF SODIUM, THORIUM, AND URANIUM FOR NEUTRONS WITH ENERGIES OF 2 TO 10 Mev. J. L. Leroy, F. C. Berthelot, and E. Pomelas (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 826-9 (Nov. 1963). (In French)

The total cross section of sodium, thorium, and uranium has been measured in the energy range 2 to 10 Mev, using a time-of-flight technique. A broad spectrum was obtained by inelastic scattering of the primary neutrons, produced by the (d,t) reaction on a U sphere surrounding the target of the pulsed accelerator. (auth)

16974 CALCULATION OF INTRANUCLEAR CASCADES BY THE MONTE CARLO METHOD. PROTONS OF 82, 110, AND 156 Mev ON ^{238}U, ^{209}Bi, ^{197}Au, ^{140}Ce, AND ^{109}Ag. E. Gradsztajn (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 829-32(Nov. 1963). (In French)

The basis of the calculations is noted. Only nucleonic collisions inside the nucleus are dealt with. Electronic computers I.B.M. 704 and 7090 were used. Each cascade calculation gives: the number and nature of the ejected nucleons; their energy and direction; and the excitation energy and the motion of the residual nucleus. (auth)

16975 DE-EXCITATION OF DYSPROSIUM NUCLEI OBTAINED BY PROTON BOMBARDMENT OF TERBIUM. M. Lefort, G. Simonoff, and X. Tarrago (Faculté des Sciences, Paris). J. Phys. (Paris), 24: 833-5(Nov. 1963). (In French)

Excitation functions have been obtained between 80 and 155 Mev for reactions (p,9n) and (p,10n) induced on ^{159}Tb. Comparison with computations based on direct interactions (p,xn) with $x = 0, 1, 2$, or 3, followed by evaporation of j neutrons shows that the choice of variation of nuclear temperature as a function of excitation energy is unambiguous. The effect on the de-excitation of the angular momentum given to the nucleus by protons is of small importance, compared to what has been observed when heavy ions produce the same residual nuclei ^{150}Dy and ^{151}Dy. (auth)

16976 REACTIONS (p,2pxn) ON THORIUM-232 AT 30 TO 120 Mev. Henri Gauvin (Faculté des Sciences, Paris). J. Phys. (Paris), 24: 836-8(Nov. 1963). (In French)

Cross sections have been measured for the production of actinium isotopes (224 to 228) in the bombardment of thorium-232 with 30- to 120-Mev protons. In the low-energy range (30 to 80 Mev) the formation of Ac is due to the (p,αxn) process. (auth)

16977 PRODUCTION OF ^{6}Li AND ^{7}Li FRAGMENTS IN SEVERAL ELEMENTS AT 156 Mev. R. Klapisch, F. Rameau, M. Epherre, and E. Gradsztajn (Faculté des Sciences, Orsay). J. Phys., (Paris), 24: 839-40(Nov. 1963). (In French)

Targets of C, N, O, V, Nb, Ta, and Pt were irradiated by 156-Mev protons. The stable isotopes of lithium produced by spallation or fragmentation reactions are extracted, in the case of metallic targets, by a vacuum distillation technique. After the lithium is deposited on the filament of the surface ionization ion source of very high sensitivity, it is mass-spectrometically analyzed. The first results are presented here. (auth)

16978 STUDY OF SOME NUCLEAR REACTIONS PRODUCED BY THE ABSORPTION OF π^- MESONS BY LIGHT NUCLEI IN CORPUSCULAR PHOTOGRAPHIC EMULSION. J. P. Massue, H. Braun, G. Baumann, and P. Cueer (Centre de Recherches Nucléaires, Strasbourg). J. Phys. (Paris), 24: 841-4(Nov. 1963). (In French)

Some types of nuclear reactions produced by the absorption of stopping π^- mesons in ^{12}C, ^{14}N, and ^{16}O nuclei are analyzed. These reactions allow us to approach the mechanism of the primary absorption event, in order to study the decay of strongly excited nuclei with two holes and to determine the binding energy of pairs of nucleons. Among other data the energy and angular spectra of the pairs of nucleons issued by the primary event are given. (auth)

16979 MESIC DISINTEGRATIONS OF SOME TYPES OF HYPERFRAGMENTS PRODUCED IN INTERACTIONS OF DIFFERENT ENERGETIC PARTICLES WITH THE NUCLEI OF INOGRAPHIC EMULSIONS. G. Baumann, H. Braun, and P. Cueer (Centre de Recherches Nucléaires, Strasbourg). J. Phys. (Paris), 24: 844-8(Nov. 1963). (In French)

Some typical examples are given of mesic hyperfragments obtained in the interactions of 25 Bev protons, 17.2 Bev/c π^- mesons, 1.5 Bev/c K^- mesons, and stopping K^- mesons in the nuclei of the nuclear emulsion. (auth)

16980 COMPARISON OF THE LOW ENERGY SPECTRA OF ^{65}Cu AND ^{51}V. Jean Vervier (CEN, Mol, Belg.). J. Phys. (Paris), 24: 848(Nov. 1963). (In French)

The low energy spectra of ^{65}Cu and ^{51}V are compared with various nuclear models. The spectrum of ^{65}Cu is described by a coupling between the odd proton and the even core, and that of ^{51}V by a configuration of the 3 protons outside the closed shells. (auth)

16981 A SEMICLASSICAL DESCRIPTION OF NUCLEAR VIBRATIONS. P. Van Leuven (Studiecentrum voor Kernenergie, Mol. Belg.). J. Phys. (Paris), 24: 849(Nov. 1963). (In French)

The eigenfrequencies and inertial parameters of an oscillating system have been related to the properties of the equilibrium configuration. The method is applied to quadrupole and octupole vibrations of closed-shell nuclei with $A \leq 60$. (auth)

16982 PRECISE MEASUREMENT OF THE EXCITED LEVELS IN ^{169}Tm. P. Van Assche, M. Neve de Mevergnies, and J. Vervier (SCK-CEN, Mol. Belg.). J. Phys. (Paris), 24: 850-2(Nov. 1963). (In French)

The energies of gamma transitions between members of the $K = \frac{1}{2}$ ground state rotational band of Tm^{169} have been precisely measured using a curved quartz crystal spectrograph. (auth)

16983 DECAY OF ^{176}W. J. Valentin and A. Santoni (Institut du Radium, Orsay, France). J. Phys. (Paris), 24: 853-4(Nov. 1963). (In French)

The decay scheme of ^{176}W is discussed in terms of expected configurations of the 83rd proton and 103rd neutron (auth)

16984 ALPHA SPECTROGRAPHY OF ^{226}Ra AND LEVELS OF EVEN-A Rn ISOTOPES. G. Bastin-Scoffier, C. F. Leang, and R. J. Walen (Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse, Orsay, France). J. Phys. (Paris), 24: 854-6(Nov. 1963). (In French)

Spectrography of the low-intensity lines of Ra shows that Rn 222, 220, and 218 have similar level schemes. However, these schemes are not explained quantitatively by theories. (auth)

16985 SOME NEW RESULTS ON THE DISINTEGRATION ^{231}Pa $\rightarrow$ ^{227}Ac. H. Abou-Leila, R. Foucher, A. G. de Pinho, N. Perrin, and M. Valadares (CNRS, Orsay, France). J. Phys. (Paris), 24: 857-8(Nov. 1963). (In French)

The ^{231}Pa $\rightarrow$ ^{227}Ac disintegration is investigated by conversion electron spectrography and gamma spectrometry. Internal conversion coefficients, intensities, and an upper limit of the half life are given for the most important transitions de-exciting the $K = \frac{1}{2} - [530]$ rotational band. (auth)

16986 MEASUREMENT OF THE MEAN LIFETIME OF THE FIRST EXCITED LEVEL OF ^{152}Gd. A. Abou-Leila, R. Foucher, and N. Perrin (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 859-61(Nov. 1963). (In French)

Using a time-to-amplitude convertor the mean life of the $2+ \rightarrow 0+$ transition to the ground state of Gd^{152} is measured as $T \sim 4 \times 10^{-11}$ sec. That of Sm^{152} is also measured. Results are discussed. (auth)

16987 SOME CONSIDERATIONS ON THE NATURE OF THE LEVELS OF ^{234}Pa. A. G. de Pinho (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 861-3(Nov. 1963). (In French)

The low-energy levels of ^{234}Pa are discussed in terms of the unified model, specially arranged to describe odd-odd deformed nuclei. The agreement between theoretical and experimental results is quite satisfactory. (auth)

16988 IONIZATION ACCOMPANYING THE DISINTEGRATION OF ^{6}He. M. Demeur and M. Meert (Institut Interuniversitaire des Sciences Nucléaires, Brussels). J. Phys. (Paris), 24: 863-4(Nov. 1963). (In French)

A theoretical evaluation of complete ionization of the Li

as a result of recoil has been made. The discrepancy with the experimental results is discussed. (auth)

16989 DECAY SCHEME OF 42-SEC ^{104}Rh. P. Fettweis and J. Vervier (CEN, Mol, Belg.). J. Phys. (Paris), 24: 865(Nov. 1963). (In French)

The γ spectrum associated with the decay of Rh^{104} (42 sec) has been investigated. The following levels of Pd^{104} are reached: 0^+ (ground state); first 2^+ (560 kev); second 2^+ (1340 kev); and second 0^+ (1800 kev). (auth)

16990 MEASUREMENT OF THE LIFETIME OF THE 2083-kev LEVEL IN ^{140}Ce. M. Dorikens, J. Demuynck, L. Dorikens-Vanpraet, and O. Segaert (Rijksuniversiteit, Ghent). J. Phys. (Paris), 24: 866-7(Nov. 1963). (In French)

The stabilization of a time-to-pulse-height converter is described. The long-term fluctuations are reduced to 0.2%. The mean life of the 2083 kev level is $(4.99 \pm 0.04) \times 10^{-9}$ sec. (auth)

16991 REACTIONS (d,p) AND (d,d) ON ^{12}C. R. Freeman, J. M. F. Jeronymo, G. S. Mani, and A. Sadeghi (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 868-70(Nov. 1963). (In French)

The excitation curves for (d,d), (d,p_0), (d,p_1), (d,p_2), and (d,p_3) on ^{12}C have been measured at 155 and 143.5° for deuterons with energy from 0.9 to 5 Mev varying by steps of 5 to 10 kev. (auth)

16992 THE POLARIZATION OF NEUTRONS FROM THE REACTION D(d,n)^{3}He FOR DEUTERONS HAVING ENERGIES OF 5.8 TO 11.3 Mev. H. Niewodniczanski, J. Szmider, and J. Szymakowski (Inst. of Nuclear Physics, Krakow). J. Phys. (Paris), 24: 871-3(Nov. 1963). (In French)

The polarization of neutrons from the D(d,n)^{3}He reaction for deuteron energies 5.8, 8.5, and 11.3 Mev at an angle of 45° c.m. has been measured by means of a coincidence polarization spectrometer with a high-pressure gas scintillation counter. The results seem to remove all sign ambiguity of the polarization. (auth)

16993 MEASUREMENTS OF THE p-γ ANGULAR CORRELATIONS IN THE (d,p) STRIPPING REACTIONS ON ^{9}Be AND ^{40}Ca. R. Achari, P. Roussel, and J. Zamudio C (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 874-6(Nov. 1963). (In French)

The reactions ^{9}Be(d,pγ)^{10}Be (3.37 Mev) and ^{40}Ca(d,pγ)^{41}Ca (1.95 Mev) are investigated at $E_d = 6.6$ Mev. The angular correlations have been measured in the reaction plane and in a plane perpendicular to it. The results are compared with the predictions of the distorted-wave stripping theory without spin-dependent terms. (auth)

16994 A CALCULATION OF THE POLARIZATION OF EMERGENT PROTONS IN A PARTICULAR TYPE OF STRIPPING REACTION. E. El-Baz (Inst. of Nuclear Physics, Lyon). J. Phys. (Paris), 24: 876-8(Nov. 1963). (In French)

Since the addition of a complementary interaction of the emerging proton with the residual nucleus in the Born approximation is useful for fitting certain stripping curves, a similar calculation is made of the polarization of the emerging proton using a Yukawa potential depending on the spin. Application is made to the reaction ^{29}Si(d,p)^{30}Si at 9 Mev. (auth)

16995 THE "SPIN CUT-OFF FACTOR" AND THE CORRELATION ENERGY FOR ^{28}Si. I. Iori and G. S. Mani (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 879-80(Nov. 1963). (In French)

The spin cut-off factor and correlation energy for ^{28}Si have been estimated from the fluctuations observed in the ^{28}Si(n,α)^{25}Mg reaction. (auth)

16996 INTERPRETATION OF PARTIAL EXCITATION FUNCTIONS FOR ^{51}V(p,n)^{51}Cr REACTIONS USING THE STATISTICAL MODEL. Y. Cassagnou, C. Levi, and L. Papineau (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 881-4(Nov. 1963). (In French)

Partial cross sections have been obtained between 2 and 4.6 Mev from measurements of the γ rays emitted in the ^{51}V(p,n) reaction. They are compared with theoretical curves from a calculation using optical-model parameters. Agreement occurred with some values of spin proposed for the first low-lying levels of ^{51}Cr. Fluctuations around a smooth curve observed in the excitation function are discussed. (auth)

16997 PERTURBATION OF THE RESONANCE LEVELS OF ATOMIC NUCLEI. J. Humblet and G. Lebon (Université, Liege). J. Phys. (Paris), 24: 885-6(Nov. 1963). (In French)

The perturbation problem for the position and width of a resonance level is discussed in the frame of the complex eigenvalue theory. The general solution of this problem of perturbation of boundary conditions is given to the first order. (auth)

16998 MEASUREMENTS OF THE ELECTROMAGNETIC TRANSITION PROBABILITIES IN THE NUCLEUS ^{16}O. S. Gorodetzky, P. Mennrath, W. Benenson, P. Chevallier, and F. Scheibling (Inst. of Nuclear Research, Strasbourg). J. Phys. (Paris), 24: 887-8(Nov. 1963). (In French)

The probabilities for several electromagnetic transitions in the nucleus ^{16}O have been studied experimentally. Values have been obtained for E2 transitions and for an E1, $\Delta T = 1$ transition (13.10 Mev → 6.05 Mev), whereas only upper limits are given for E1, $\Delta T = 0$ transitions. (auth)

16999 DOUBLE GAMMA EMISSION IN MONOPOLAR TRANSITIONS. S. Gorodetzky, G. Sutter, P. Chevallier, F. Scheibling, and P. Mennrath. J. Phys. (Paris), 24: 889-92(Nov. 1963). (In French)

An experimental study of double gamma emission in some monopolar transitions (6.05 Mev of ^{16}O, 3.35 Mev in ^{40}Ca, and 1.75 Mev in ^{90}Zr) gives for the probability of this phenomenon: $\Gamma_{\gamma\gamma}/\Gamma_\pi = (2.5 \pm 1.1) \times 10^{-3}$ for ^{16}O; $\Gamma_{\gamma\gamma}/\Gamma_\pi \leq 2.1 \times 10^{-3}$ for ^{40}Ca; and $\Gamma_{\gamma\gamma}/\Gamma_{\pi+e^-} \leq 8.8 \times 10^{-4}$ for ^{90}Zr. (auth)

17000 EMISSION OF INTERNAL PAIRS BY THE 3.63-Mev LEVEL IN ^{18}O. S. Gorodetzky, R. E. Pixley, A. Gallmann, G. Frick, J. P. Coffin, and G. Sibille (Inst. of Nuclear Research, Strasbourg). J. Phys. (Paris), 24: 892-3(Nov. 1963). (In French)

The yield of pairs and gamma rays from the 3.63-Mev state in ^{18}O has been measured. The relative pair width of this state is found to be 1.9×10^{-3} of the gamma width. This corresponds to a nuclear monopole matrix element of 3.3×10^{-26} cm^2. (auth)

17001 EXCITED LEVELS OF ^{22}Na FOLLOWING ALPHA-PARTICLE-INDUCED REACTIONS ON ^{19}F. R. Freeman, J. M. F. Jeronymo, G. S. Mani, and A. Sadeghi (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 894-9(Nov. 1963). (In French)

The gamma rays emitted following alpha-particle bombardment of ^{19}F have been studied for bombarding energies ranging from 2 to 5 Mev in steps of 5 kev. (auth)

17002 MEASUREMENT OF THE FISSION CROSS SECTION OF ^{239}Pu. G. Fraysse and A. Prosdocimi

(Euratom, [Brussels]). J. Phys. (Paris), 24: 899-900 (Nov. 1963). (In French)

The use of semiconductors and a double gas scintillator has enabled some difficulties to be eliminated from the measurement of σ_f (^{239}Pu). Neutron energies used were 0.03, 0.062, and 0.27 ev. (auth)

17003 ENERGY BALANCE FOR THE TERNARY FISSION OF ^{235}U INDUCED BY SLOW NEUTRONS. I. G. Schroder, J. A. Moore, and A. J. Deruytter (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). J. Phys. (Paris), 24: 900(Nov. 1963). (In French)

A detailed energy-balance for the ternary fission of ^{235}U by thermal neutrons was made by three measurements: comparison of the kinetic energy distribution of the fission fragments in binary fission of ^{235}U and in tripartition; a comparison of the total kinetic energy distributions of the fragments for the two same phenomena; and a study of the dependence of the mean energy of the ternary particles on the total kinetic energy of the associated heavy fragments. (auth)

17004 ANGULAR DISTRIBUTIONS AND CROSS SECTIONS FOR THE FISSION OF URANIUM, BISMUTH, AND GOLD, INDUCED BY 156-Mev PROTONS. L. Kowalski and C. Stephan (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 901-3(Nov. 1963). (In French)

We have measured with solid state detectors differential cross sections of fission of U, Bi, and Au induced by 156-Mev protons. We have found in the center of mass a small positive anisotropy for all the targets, that is + (6 ± 1%) for U, + (13 ± 2%) for Bi, and + (11 ± 3%) for Au. Total fission cross sections were found to be: 1370 ± 250 mb for uranium; 126 ± 20 mb for bismuth; and 24 ± 4 mb for gold. (auth)

17005 MEASUREMENTS OF COINCIDENCES DUE TO THE REACTIONS OF ^{6}Li ON ^{6}Li AND ^{9}Be. R. Ballini and N. Saunier (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 904-5(Nov. 1963). (In French)

Final states including ^{10}B*, ^{7}Li*, or ^{7}Be* have been selected by coincidence between charged particles and γ-rays emitted from these excited states, "multiparametric" recording of energy spectra being used. (auth)

17006 STUDY OF THE GAMMA RAYS FROM THE REACTION OF LITHIUM-6 IONS ON A TARGET OF LITHIUM-6. M. Coste (Faculté des Sciences, Bordeaux), L. Marquez, and S. Shafroth. J. Phys. (Paris), 24: 906-7 (Nov. 1963). (In French)

We have measured the excitation functions of the gamma rays from the first excited states of ^{7}Li, ^{7}Be, and ^{10}B, produced by the reaction ^{6}Li + ^{6}Li between 1 and 2 Mev. The results are in agreement with the Gamow function. (auth)

17007 OBSERVATION OF THE NUCLEAR REACTIONS PRODUCED BY LITHIUM-6 IONS AT 5 Mev. C. Lemeille (Centre d'Études Nucléaires, Saclay, France), D. Manesse, L. Marquez, N. Saunier, and J. L. Quebert. J. Phys. (Paris), 24: 908-10(Nov. 1963). (In French)

We have studied the reaction ^{6}Li + ^{6}Li from 1 to 5 Mev. We find that only one cluster state with the d + ^{6}Li structure is formed in this energy region. We have also studied the reaction ^{6}Li + ^{10}B. We find the groups α_0, α_1, α_2, and α_3 a continuous spectrum with a high intensity. This continuum seems to come from the decay of an excited state of ^{12}C with a d + ^{10}B structure. (auth)

17008 STUDY OF THE REACTION ^{6}Li + ^{7}Li → α + ^{5}Be WITH ^{6}Li IONS OF 2 Mev. A. Garin and L. Marquez (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 911-14(Nov. 1963). (In French)

The continuous spectrum observed in this reaction has been analyzed assuming that it comes from the decay of an excited state of ^{9}Be, having a ^{7}Li + d structure. Agreement is obtained. (auth)

17009 MEASUREMENT OF THE NEUTRON SPECTRUM PRODUCED BY ^{7}Li IONS ON ^{6}Li AT 2 Mev. C. Karadeniz (Univ. of Istanbul) and C. Lemeille. J. Phys. (Paris), 24: 915-16(Nov. 1963). (In French)

We have measured the energy spectrum of the neutrons from the reaction ^{7}Li + ^{6}Li. The spectrum is compatible with the assumption that the most intense reaction goes through an excited state of ^{9}Be, having the cluster structure of ^{7}Li + d. (auth)

17010 COMPOUND NUCLEI AND TANGENTIAL COLLISIONS IN THE REACTIONS OF ^{20}Ne WITH THE Ag AND Br NUCLEI OF IONOGRAPHIC EMULSIONS. Raymond Pfohl, Christiane Winter-Gegauff, and Jean-Pierre Lonchamp (Centre de Recherches Nucléaires, Strausbourg). J. Phys. (Paris), 24: 917-21(Nov. 1963). (In French)

The energy of the incident Ne varied from 80 to 200 Mev. The angular distributions, energy spectra, recoil nuclei, and emission of high-energy heavy ions are studied for classification of reaction mechanisms. Taking three-or-more-branched stars, tangential collisions provide 13% of reactions. Most of the other reactions go through complete fusion of target and projectile. Statistical model evaporation alone does not explain the de-excitation. (auth)

17011 ANOMALOUS BEHAVIOR OF THE β-γ DIRECTIONAL CORRELATION IN THE DISINTEGRATION OF ^{166}Ho (27 hr). L. Grenacs (Université, Louvain, Belg.), E. Creutz, J. de Raedt, and J. Lehmann. J. Phys. (Paris), 24: 924(Nov. 1963). (In French)

Measurements yield a non-constant attenuation factor G_2 for the perturbed directional correlation of the cascade $\beta_{1760\,kev}$–$\gamma_{81\,kev}$ as a function of β energy. The measurement was made with a Ho_2O_3 polycrystalline source. An attempt is made to explain this variation by an influence of the nuclear recoil on the perturbation. (auth)

17012 NUCLEAR PARAMETERS IN THE BETA DECAY OF ^{72}Ga AND ^{76}As. J. Grenacs and J. de Raedt (Université, Louvain, Belg.). J. Phys. (Paris), 24: 925(Nov. 1963). (In French)

The β-γ directional correlation of the internal and external β disintegration of ^{72}Ga and ^{76}As was measured. The results are analyzed in the framework of the modified B_{ij} approximation. (auth)

17013 ON THE SPIN OF THE GROUND STATE OF ^{144}Pr. E. Creutz, J. de Raedt, and L. Grenacs (Université, Louvain, Belg.). J. Phys. (Paris), 24: 926(Nov. 1963). (In French)

The $\beta_{2290\,kev}$–$\gamma_{690\,kev}$ directional correlation, measured as a function of the β energy, is compatible with the sequence of spins $(0^-)\beta(2^+)\gamma(0^+)$. (auth)

17014 TWO LEVELS OF ^{101}Ru. L. Pastor and N. Perrin (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 927-9(Nov. 1963). (In French)

Two levels of ^{101}Ru have been studied with the help of a well crystal and angular correlation measurements. The conversion coefficients of the γ and the spin of the levels are given. (auth)

17015 GAMMA–GAMMA ANGULAR CORRELATIONS IN THE DISINTEGRATION OF ^{124}Sb (1.5 min). F. Binon and J. Vervier (CEN, Mol, Belg.). J. Phys. (Paris), 24: 929-30(Nov. 1963). (In French)

The γ–γ angular correlations for the 505–645–603 kev triple cascade in the decay of ^{124}Sb (1.5 min) to ^{124}Te have

been measured. The results are in agreement with a spin sequence 6−4−2−0 for the 1753, 1248, 603, and 0 kev levels in ^{124}Te. (auth)

17016 ABSOLUTE DETERMINATION OF THE INTERNAL CONVERSION COEFFICIENTS OF LOW-ENERGY TRANSITIONS IN ^{153}Eu. P. Chedin and A. Moussa (Faculté des Sciences, Grenoble, France and Centre d'Etudes Nucléaires, Grenoble, France). J. Phys. (Paris), 24: 930-3 (Nov. 1963). (In French)

A report is given of the determination of internal conversion coefficients of the two main low-energy transitions in ^{153}Eu (69.7 and 103.2 kev). The external conversion (photoelectric effect) of the γ rays and rearrangement x rays is used. The source-converter geometry minimizes photoelectric anisotropy corrections. (auth)

17017 CONTRIBUTION TO THE STUDY OF THE INTERNAL CONVERSION ELECTRONS OF THE DISINTEGRATION ^{151}Pm → ^{151}Sm. G. Marguier, R. Chéry, A. Juillard, and A. Moussa (Faculté des Sciences, Lyon and Centre d'Études Nucléaires, Grenoble, France). J. Phys. (Paris), 24: 934-5(Nov. 1963). (In French)

Data are indicated about transitions of 4.80, 76.2, 104.8, 163, and 168 kev. (auth)

17018 MEASUREMENT OF THE BETA-CIRCULARLY POLARIZED GAMMA ANGULAR CORRELATION IN ^{111}Ag. Delabaye, Deutsch, and Lipnik (CPN, Louvain, Belg.). J. Phys. (Paris), 24: 936-7(Nov. 1963). (In French)

Measurements of correlations between β rays have been carried out on ^{111}Ag. Results are used for an experimental test of the "conserved vector current" theory of weak interaction. (auth)

17019 EXCHANGE CONTRIBUTION TO THE SCATTERING OF ALPHA PARTICLES BY LIGHT NUCLEI. C. Quesne and C. Willain (Institut Interuniversitaire des Sciences Nucléaires, Brussels). J. Phys. (Paris), 24: 940-1(Nov. 1963). (In French)

The contribution of the exchange term to the elastic scattering differential cross section of α particles has been calculated in the Born approximation, the target being described by the alpha-model. (auth)

17020 EXCITATION OF COLLECTIVE LEVELS BY ^{3}He. R. Ceuleneer and M. Demeur (Groupe des Basses Énergies, Brussels). J. Phys. (Paris), 24: 942(Nov. 1963). (In French)

In order to identify the collective states of a nucleus, we propose the investigation of these states by inelastic scattering with alpha particles and with ^{3}He. (auth)

17021 ELASTIC AND INELASTIC SCATTERING OF 12.8-Mev DEUTERONS ON ^{28}Si AND EXCITATION OF THE CORE OF ^{27}Al. H. Niewodniczanski, J. Nurzynski, and A. Strzalkowski (Inst. of Nuclear Physics, Krakow). J. Phys. (Paris), 24: 944-7(Nov. 1963). (In French)

Angular distributions for elastic and inelastic scattering of 12.8-Mev deuterons on ^{28}Si nuclei have been measured by means of a magnetic spectrometer with an energy resolution of 150 kev. Measured angular distributions for the elastic and inelastic scattering corresponding to the first excited state of the ^{28}Si nucleus have been fitted with the theory of diffraction scattering. The comparison of the results obtained with the results on the inelastic scattering on ^{27}Al gives some evidence on the core excitation model for the ^{27}Al nucleus. (auth)

17022 DECOMPOSITION OF THE LEVELS AT 16.626 AND 16.921 Mev IN BERYLLIUM-8. R. Bilwes, B. Bourotte and D. Magnac-Valette (CRN, Strasbourg). J. Phys. (Paris), 24: 948-51(Nov. 1963). (In French)

An α−α coincidence method is used to detect the particles coming from the breakup of ^{8}Be in the 16.626 and 16.921 Mev excited states. The 16.626 Mev ^{8}Be state has T = 1. The observed breakup does not fit the isobaric-spin conservation rule. (auth)

17023 STUDY OF LEVELS OF ^{8}Be. R. Freeman and G. S. Mani (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 951-3(Nov. 1963). (In French)

Using the multilevel formula of the Wigner-Eisenbud formalism the parameters for some states of about 23 Mev excitation in Be^{8} have been calculated. (auth)

17024 ELECTRODISINTEGRATION OF ^{9}Be. H. Nguyen Ngoc and J. Perez y Jorba (École Normale Supérieure, Orsay, France). J. Phys. (Paris), 24: 965-6(Nov. 1963). (In French)

The subtraction technique of the radiative tails on the spectra of electrons scattered by ^{9}Be is presented. Inelastic from factors are obtained. (auth)

17025 SCATTERING OF HIGH-ENERGY ELECTRONS BY PHOSPHORUS-31. R. Lombard, P. Kossanyi, and R. Bishop (École Normale Supérieure, Orsay, France). J. Phys. (Paris), 24: 968-9(Nov. 1963). (In French)

Inelastic scattering of high energy electrons for ^{31}P has been observed. Levels at 1.26, 2.23, 3.13, and 3.5 Mev above the ground state are excited E2 transitions. Level 5.01 Mev in magnetic octupole levels 4.63 and 5.7 Mev are electric octupole and could be produced by the splitting of 3^- (5.80 Mev) levels of ^{32}S. (auth)

17026 STUDY OF THE INELASTIC SCATTERING OF ELECTRONS BY THE NUCLEI ^{6}Li AND ^{7}Li. M. Bernheim and G. R. Bishop (École Normale Supérieure, Orsay, France). J. Phys. (Paris), 24: 970-2(Nov. 1963). (In French)

We have measured the form factors for transitions to the following excited states by the inelastic scattering of electrons: 2.189, 3.57, and 4.52 Mev of ^{6}Li; and 0.478, 4.61, 5.76, and 6.8 Mev of ^{7}Li. The dependence of the form factors on the momentum transfer indicates the principal components of the wave functions describing these states. (auth)

17027 STUDY OF THE EXCITED STATES OF OXYGEN-16 BETWEEN 11 AND 14 Mev BY INELASTIC SCATTERING OF ELECTRONS. G. R. Bishop, C. Bétourné, and D. B. Isabelle (École Normale Supérieure, Orsay, France). J. Phys. (Paris), 24: 973(Nov. 1963). (In French)

We have studied the inelastic scattering of electrons by ^{16}O for excitation energies between 11 and 14 Mev. Since the spins and parities of the levels are already known, it is possible to separate the contributions of individual levels even though the energy resolution is less than the separation of the levels. The reduced transition probabilities are tabulated. (auth)

17028 THE SPECTRUM FROM INELASTIC SCATTERING OF HIGH-ENERGY ELECTRONS BY CARBON. [PART] II. Paul Bounin and G. R. Bishop (École Normale Supérieure, Orsay, France). J. Phys. (Paris), 24: 974-6(Nov. 1963). (In French)

We measured the spectrum of 200 Mev electrons scattered at 135° by a carbon target. Some nuclear levels appear, together with the quasi-elastic spectrum. Both are interpreted, the latter with the impulse approximation. (auth)

17029 ANGULAR DISTRIBUTION AND CROSS SECTION FOR THE REACTION ^{6}Li(p,^{3}He)^{4}He. J. M. F. Jeronymo, G. S. Mani, and A. Sadeighi (Centre d'Études

Nucléaires, Saclay, France). J. Phys. (Paris), 24: 976-7 (Nov. 1963). (In French)

The excitation curve and angular distribution from the $^{6}Li(p,\alpha)^{3}He$ reaction was measured for proton energies from 2 to 5 Mev. The presence of a positive parity state in this energy region is indicated. (auth)

17030 EXCITED LEVELS IN ^{19}F BY STUDY OF THE REACTION $^{18}O(p,\alpha_0)^{15}N$. S. Gorodetzky, M. Port, J. Graff, and J. M. Thirion (Inst. of Nuclear Research, Strasbourg). J. Phys. (Paris), 24: 978-83(Nov. 1963). (In French)

Excited levels of ^{19}F have been studied by the reaction $^{18}O(p,\alpha)^{15}N$ using ^{18}O-enriched self-supporting targets of Al_2O_3. Two simultaneously obtained excitation curves at $\theta_{lab} = 165$ and 90° have been observed and tabulated. (auth)

17031 STUDY OF LOW LEVELS OF ^{6}Li BY THE REACTION $^{7}Li(^{3}He,\alpha)^{6}Li$. J. Linck, I. Nicolas-Linck, R. Bilwes, and D. Magnac-Valette (Centre de Recherches Nucléaires, Strasbourg). J. Phys. (Paris), 24: 983-7(Nov. 1963). (In French)

At low incident energy and 90° (lab. angle) the level at 4.52 Mev (T = 0) of ^{6}Li is not found. Only one level at 5.47 ± 0.04 Mev is seen in the neighborhood of 5.5 Mev. (auth)

17032 DETERMINATION OF DENSITY FUNCTIONS IN RHODIUM 103 FOR "s" AND "p" NEUTRONS. P. Ribon and A. Michaudon. J. Phys. (Paris), 24: 987-90(Nov. 1963). (In French)

From the ^{103}Rh total neutron cross section, measured up to 800 ev, we have determined values of s and p wave neutron strength functions: $S_0 = (0.46 \pm 0.05) \times 10^{-4}$; and $S_1 = 5.5 \times 10^{-4}$. Mean spacing of s resonances is 35 ev and about 16 ev for p resonances. The nuclear radius is $R = (6.3 \pm 0.2)\ 10^{-13}$ cm. (auth)

17033 STATISTICAL PROPERTIES OF THE INTERACTION OF RESONANCE NEUTRONS WITH MEDIUM AND HEAVY NUCLEI. I. PROGRESS IN THE INSTALLATION. G. Bianchi, J. Colmin, C. Corge, V.-D. Huynh, J. Julien, J. Morgenstern, F. Netter, and M. Vastel (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 990-3 (Nov. 1963). (In French)

Neutron time-of-flight experiments are continued at the linear accelerator, with emphasis to the determination of the resonance radiation width Γ_γ. Progress of the apparatus includes high time-of-flight resolution (0.5 nanosecond/meter) and utilization, as gamma-ray detectors, of one big liquid spherical tank and one high-resolution assembly constituted by a central crystal and an annular crystal. (auth)

17034 STATISTICAL PROPERTIES OF THE INTERACTION OF RESONANCE NEUTRONS WITH MEDIUM AND HEAVY NUCLEI. II. STUDY OF SCATTERING WIDTHS FOR TARGET NUCLEI OF SPIN ½. G. Bianchi, J. Colmin, C. Corge, V.-D. Huynh, J. Julien, J. Morgenstern, F. Netter, and M. Vastel (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 994-6(Nov. 1963). (In French)

A high-resolution (0.5 nanosecond/meter) study up to 30 kev neutron energy of Y resonances gives evidence for the resonance at 2597 kev being a doublet, and probably also the resonance at 11,570 ev. The possibility of a correlation between the strength function and the spin J of the resonances is discussed. The number of resonances studied does not allow any conclusion for Y. Results relative to Pt and Tm are in agreement with the classical dependence in (2J + 1). (auth)

17035 STATISTICAL PROPERTIES OF THE INTERACTION OF RESONANCE NEUTRONS WITH MEDIUM AND HEAVY NUCLEI. III. STUDY OF RESONANCES OF Co, La, Pr, AND Nd. G. Bianchi, J. Colmin, C. Corge, V.-D. Huynh, J. Julien, J. Morgenstern, F. Netter, and M. Vastel (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 997-8(Nov. 1963). (In French)

The resonance doublet in cobalt at 4.34 kev (J = 4) and 4.99 kev (J = 3) is studied. The systematic survey of nuclei in the vicinity of the 82-neutron closed shell gives resonance parameters for La, Pr, and Nd. The potential scattering cross section value for Pr of 5.5 ± 2 barns is measured by the interference effect, in agreement with previous direct measurements. Evidence is given for a resonance doublet in ^{145}Nd at 102.2 ev (J = 3) and 103.6 ev (J = 4). (auth)

17036 STATISTICAL PROPERTIES OF THE INTERACTION OF RESONANCE NEUTRONS WITH MEDIUM AND HEAVY NUCLEI. IV. STUDY OF RADIATION WIDTHS. G. Bianchi, J. Colmin, C. Corge, V.-D. Huynh, J. Julien, J. Morgenstern, F. Netter, and M. Vastel (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 999-1002(Nov. 1963). (In French)

Relative measurement of the ratio Γ_γ/Γ is made from resonance to resonance with a large liquid scintillator. Results are given for Nd and Pt. Occurrence of fluctuations of the Γ_γ values is discussed. The annular crystal spectrometer is used to investigate the possible contribution from direct radiative capture in Au. (auth)

17037 DETERMINATION OF THE SPIN OF RESONANCES IN $^{149}Sm + n$. H. Ceulemans, F. Poortmans, and M. Neve de Mevergnies (CEN, Mol. Belg.). J. Phys. (Paris), 24: 1003-4(Nov. 1963). (In French)

The spins of the slow neutron resonances at 0.096 and 0.87 ev in ^{149}Sm were determined by a resonance scattering method. It was found that J = 3 for both resonances. (auth)

17038 TOTAL CROSS SECTION OF NICKEL FOR NEUTRONS HAVING ENERGIES OF 175 TO 300 kev. A. Perrin, G. Surget, and C. Thibault (Commissariat à l'Énergie Atomique, [Paris]). J. Phys. (Paris), 24: 1005-7(Nov. 1963). (In French)

Measurements have been made with a 2 Mev pulsed Van de Graaff associated with a time-of-flight apparatus. The total cross section of nickel was studied for neutron energies from 180 to 300 kev. Values agree with previous determinations, but show a complex structure. (auth)

17039 STUDY OF THE INELASTIC SCATTERING OF 800-kev NEUTRONS BY ^{127}I. J. Cabe, M. Laurat, and P. Yvon. J. Phys. (Paris), 24: 1008-9(Nov. 1963). (In French)

The inelastic scattering of 800-kev neutrons is shown to be isotropic for the first two levels of ^{127}I at 59 and 203 kev. The fast coincidence between the scattered neutron and the de-excitation gamma ray is the analytic method used. (auth)

17040 STUDY OF THE GIANT RESONANCE IN HEAVY NUCLEI BY ELASTIC SCATTERING OF BREMSSTRAHLUNG. M. Langevin and J. M. Loiseaux (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. Phys. (Paris), 24: 1027-9(Nov. 1963). (In French)

The scattering cross sections and angular distributions of the scattered photons in the giant resonance energy region are studied for Au, Ta, Ho, and Er. The results obtained near the resonance maximum agree with the predictions of a collective model. The disagreement in the upper energy range can be explained by the appearance of a quadrupolar excitation. (auth)

17041 ANALYSIS OF THE ELASTIC SCATTERING OF DEUTERONS ON NICKEL AT 21.6 Mev WITH TENSOR PO-

TENTIALS. J. Raynal (Centre d'Études Nucléaires, Saclay, France). J. Phys. (Paris), 24: 1044-7(Nov. 1963). (In French)

Extensive calculations have been made using a radius of real central potential between 1.15 and 1.3 fermis. Four kinds of solution can be defined; for each of these, the polarization parameters do not vary much and remain almost the same for these solutions two by two. Nevertheless, very precise measurements can fix the radius and the depth of the real potential. The calculations have been extended to Mg and Ca at the same energy. The results obtained for Ca could lead to a striking simplification of the problem. (auth)

17042 INELASTIC SCATTERING OF 155-Mev PROTONS ON ^{28}Si, ^{32}S, AND ^{40}Ca. W. J. Hornyak, J. C. Jacmart, M. Riou, J. P. Garron, Ch. Rahla, and M. Liu (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. Phys. (Paris), 24: 1052-5(Nov. 1963). (In French)

The angular distributions of inelastic scattering of protons have been studied for the low-lying excited states of ^{28}Si, ^{32}S, and ^{40}Ca. Comparison has been made with results obtained by inelastic scattering of electrons. (auth)

17043 STUDY OF THE NUCLEI ^{40}Ca, ^{11}B, AND ^{10}B BY MEANS OF THE (p,d) REACTION AT 155 Mev. D. Bachelier, M. Bernas, I. Brissaud, C. Detraz, and P. Radvanyi (Faculté des Sciences, Orsay, France). J. Phys. (Paris), 24: 1055-8(Nov. 1963). (In French)

The energy spectra of the deuterons from (p,d) reaction are discussed. For ^{40}Ca, pick-up of $1d_{3/2}$ and $2s_{1/2}$ neutrons and perhaps also of $1d_{5/2}$ neutrons is observed. For ^{11}B and ^{10}B, one observes spectra whose general behavior is intermediate between that of ^{12}C and ^{9}Be. (auth)

17044 STUDY OF THE STRONGLY EXCITED LEVELS OF ^{12}C BY THE POLARIZATION OF INELASTICALLY SCATTERED PROTONS. X. de Bouard, J. G. Fox, B. Geoffrion, N. Marty, C. Rolland, and B. Tatischeff. J. Phys. (Paris), 24: 1059-62(Nov. 1963). (In French)

In general agreement with theory, protons inelastically scattered in the excitation of levels other than $\Delta T = 0$ favored parity, show a very low polarization. Polarization of 150-Mev protons from excited states of high energy in ^{12}C gives information on the nature of these levels. (auth)

17045 STUDY OF THE ^{12}C(p,2p)^{11}B REACTION WITH THE AID OF A PROPANE BUBBLE CHAMBER. T. Yuasa and M. Poulet (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. Phys. (Paris), 24: 1062-4 (Nov. 1963). (In French)

The cross sections and mean reducing factors for the $p_{\frac{1}{2}}$ and $s_{\frac{1}{2}}$ states are calculated in the neighborhood of 100 Mev. It is difficult to describe the momentum distribution of recoiled nuclei on the basis of the simple impulse approximation hypothesis. (auth)

17046 ELASTIC AND INELASTIC SCATTERING OF 28.5 Mev ALPHA PARTICLES BY MEDIUM-WEIGHT NUCLEI. Isao Kumabe, Hiroshi Ogata, Makoto Inoue, Yasuhiko Okuma, and Jiro Muto (Kyoto Univ.). J. Phys. Soc. Japan, 19: 147-58(Feb. 1964).

Elastic and inelastic scattering of 28.5-Mev alpha particles by Ni^{60}, Ni^{58}, Ti^{48}, Co^{59}, and Al^{27} was studied. The angular distributions of the prominent group from the 2^+ first excited state and the 3^- "anomalous" group for even nuclei were fitted by calculations based on the Blair model. The angular distributions of the 4^+ groups near 2.5 Mev in Ni^{60}, near 2.5 Mev in Ni^{58}, and near 3.3 Mev in Ti^{48} were found to have intermediate phase between the corresponding elastic distribution and the corresponding first 2^+ inelastic distribution. On the other hand, the angular distributions of the 2^+ groups near 3.1 Mev in Ni^{60}, near 3.0 Mev in Ni^{58}, and near 2.4 Mev in Ti^{48} were found to be almost exactly out of phase with the corresponding elastic distributions. Large cross sections of the inelastic alpha scattering to the 2.21- and 3.0-Mev states in Al^{27} suggest that these states are the members of a $K^\pi = 5/2^+$ rotational band based on the ground state. (auth)

17047 GAMMA-GAMMA ANGULAR CORRELATIONS IN Sb^{125}. Takashi Inamura, Takeki Iwashita, Yoshio Ikemoto, and Seizaburo Kageyama (Tokyo Univ.). J. Phys. Soc. Japan, 19: 239(Feb. 1964).

The level structure of ^{125}Te is confirmed by γ-γ coincidences, and the spin of the higher states of ^{125}Te is investigated by γ-γ directional correlation measurements. (R.E.U.)

17048 ANGULAR DISTRIBUTION OF FAST NEUTRONS INELASTICALLY SCATTERED BY IRON. G. C. Bonazzola, T. Bressani, P. Brovetto, E. Chiavassa, and R. Demicheli (Istituto Nazionale di Fisica Nucleare, Turin). Nucl. Phys., 51: 353-62(Feb. 1964).

The angular distribution of 14.7 Mev neutrons inelastically scattered by a Fe target was measured by the time-of-flight technique. The energy bias of the neutron detector was 4 Mev. The results showed that the high energy neutrons come out from direct reaction, while the low energy neutrons seem to be due to an evaporation process. An attempt was made to calculate the energy dependence of the inverse cross section. (auth)

17049 SPALLATION CROSS SECTIONS FOR LONG-LIVED RADIONUCLIDES IN IRON AND LIGHT NUCLEI. Masatake Honda (Univ. of California, San Diego, La Jolla, Calif.) and Devendra Lal (Tate Inst. of Fundamental Research, Bombay). Nucl. Phys., 51: 363-8(Feb. 1964).

The cross sections for the formation of the long-lived radionuclides ^{10}Be, ^{32}Si, ^{40}K, ^{42}Ar, and ^{44}Ti and a few short-lived nucleides in Fe by 730-Mev protons and of ^{10}Be in C, N, and O by 220-Mev protons were measured. These data were obtained for interpretation of the observed results of cosmic ray induced radioactivity in meteorites and on the earth. Over a wide range of mass numbers, the measured cross sections in iron for various radioactive nucleides, especially those close to the nuclear stability line, can be expressed fairly accurately by a semi-empirical relation first discussed by Rudstam. Using this relation, reasonable values for the half-lives of the radioactive nucleides ^{32}Si and ^{44}Ti, for which only crude estimates were available, were calculated. (auth)

17050 NUCLEAR POTENTIAL IN AXIOMATIC QUANTUM FIELD THEORY. C. H. Lee (McMaster Univ. Hamilton, Can.). Nucl. Phys., 51: 369-82(Feb. 1964).

It is shown here that a transition from axiomatic quantum field theory to Schrödinger equation can be accomplished provided the extrapolation of the scattering matrix off the energy shell is performed in a certain way. However, if one wants an equation which is valid for all physical energies, the appropriate equation is what is called here the "Dirac equation" from which the Schrödinger equation is obtained as an approximation. The potential appearing in the "Dirac equation" is expressed in closed form in terms of field-theory matrix elements. (auth)

17051 THE DECAY OF Ag^{110m}. J. Schintlmeister and L. Werner (Zentralinstitut fur Kernphysik, Bereich "Physik der Atomkerne," Rossendorf, Ger.). Nucl. Phys., 51: 383-94(Feb. 1964). (In German)

Using a magnetic intermediate image beta spectrometer the beta spectrum and the conversion electrons of pile irradiated silver were studied. The decay has been observed during a time of about two half lives of Ag^{110i}. The sources prepared in several ways had a thickness of about 0.3 mg/cm^2 or 2 mg/cm^2. In the present study there was paid particular attention to the measurements of the low energy beta components and the conversion electrons below 500 kev and above 1500 kev. (auth)

17052 POLARIZATION OF NEUTRONS FROM THE $T(p,n)He^3$ REACTION FROM 1.9 TO 3.5 Mev. C. A. Kelsey, B. Hoop, Jr., and P. Vander Maat (Univ. of Wisconsin, Madison). Nucl. Phys., 51: 395-400(Feb. 1964). (TID-19573)

Previous measurements on the polarization of the neutrons from the $T(p,n)He^3$ reaction were extended to lower energies and other emission angles. A solenoid was used to precess the spin vector of the neutrons and the polarization was determined from the observed asymmetry in scattering from helium. The results indicate that the polarization is largest near a center-of-mass emission angle of 45° with a value of 0.40 between 2.0 and 2.4 Mev bombarding energy. (auth)

17053 THEORETICAL STUDY OF A SIMPLE MODEL OF THE STRIPPING REACTION ON Be^9 AND N^{14}. J. L. Ballot, P. Dumontet, B. Picinbono, and F. Saya (Institut d'Études Nucléaires, Alger, Algeria). Nucl. Phys., 51: 401-9(Feb. 1964). (In French)

A treatment is given of deuteron stripping reactions on Be^9 and N^{14}, based on a modification of the Butler theory, taking into account interactions of the emerging particle with the weakly bound particles of the target nucleus. This method allows a more explicit interpretation of certain experimental results. (auth)

17054 THE PHENOMENOLOGY OF THE EFFECTIVE TWO-BODY FORCES FOR C^{12} AND O^{16} IN THE PARTICLE-HOLE MODELS. Vincent Gillet (Centre d'Études Nucléaires, Saclay, France and Carnegie Inst. of Tech., Pittsburgh). Nucl. Phys., 51: 410-26(Feb. 1964).

The characteristics of the effective two-body forces of shell-model calculations were derived by relating the force parameters to the experimental spectra of C^{12} and O^{16} in the framework of the particle-hole models of nuclear excitations. Following a least-squares search, the regions of best agreement between theory and experiment in the force-parameter space were found to have the form of long and narrow valleys, exhibiting an approximately linear relationship between every pair of parameters. These regions have the following strong characteristics: a positive Heisenberg component, a Majorana component equal to or greater than the Wigner one, and a singlet to triplet strength ratio of 0.4–0.7. When using the random phase approximation the region of best agreement for C^{12} is identical to that for O^{16}, but that the regions are markedly different when using the usual shell-model approximation, i.e., diagonalizing the interaction in the subspace of one-particle-one-hole configurations. (auth)

17055 THE ENERGY LEVELS OF ^{22}Na AND NEUTRON PRODUCTION IN STARS. S. Hinds, M. Marchant, and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nucl. Phys., 51: 427-32(Feb. 1964).

The energy levels of ^{22}Na up to an excitation of 7.88 Mev were measured by magnetic analysis of the $^{24}Mg(d,\alpha)^{22}Na$ and $^{23}Na(^3He,\alpha)^{22}Na$ reactions. The assignment of the second T = 1 state is discussed. In connection with the $^{21}Ne(\alpha,n)^{24}Mg$ reaction as a source of neutrons in stars, it is shown that there are at least two and possibly four resonances in the $^{21}Ne(p,\gamma)^{22}Na$ reaction at stellar temperatures. (auth)

17056 THE RADIOACTIVE DECAY OF CADMIUM-115m. V. Visweswara Rao, V. Lakshminarayana, and Swami Jnanananda (Andhra Univ., Waltair, India). Nucl. Phys., 51: 442-8(Feb. 1964).

The radioactive decay of cadmium-115m is studied with an electronic summing scintillation spectrometer. New gamma-components with energies 165 ± 5, 270 ± 5, 300 ± 5, 650 ± 10, 910 ± 10, 1125 ± 10, 1420 ± 15, and 1560 ± 15 kev are observed. These have been fitted into a comprehensive level scheme by introducing three new levels at 650, 1125, and 1560 kev. Possible spin and parity assignments are made based on energy and intensity considerations. (auth)

17057 STATISTICAL MODEL ANALYSIS OF (n,α) REACTIONS. I. EXCITATION FUNCTIONS AND ENERGY SPECTRA OF (n,α) REACTIONS IN LIGHT AND MEDIUM NUCLEI. E. Saetta-Menichella, F. Tonolini, and L. Tonolini-Severgnini (CISE, Milan and Università, Milan). Nucl. Phys., 51: 449-59(Feb. 1964).

The (n,α) reactions referring to nuclei up to A ≈ 70 are examined by means of the statistical model. The analysis of the energy spectra and excitation functions leads to results in agreement with the evaporation mechanism. In excitation functions computations it is necessary to introduce as a parameter an "effective threshold" for the (n,αn) multiple reaction. (auth)

17058 STATISTICAL MODEL ANALYSIS OF (n,α) REACTIONS. II. CROSS-SECTIONS INDUCED BY 14 Mev NEUTRONS. U. Facchini, E. Saetta-Menichella, F. Tonolini, and L. Tonolini-Severgnini (CISE, Milan and Università, Milan). Nucl. Phys., 51: 460-9(Feb. 1964).

The cross sections of (n,α) reactions induced by 14 Mev neutrons on nuclei ranging from sodium to uranium, are computed by the statistical model. For nuclei up to A ≈ 80 the calculated and experimental $\sigma(n,\alpha)$ are in good agreement, while in the region between the complete neutron shells the ratio $\sigma(n,\alpha)_{exp}/\sigma(n,\alpha)_{theor}$ may even be greater than 100. The statistical model explains the high values of the cross section corresponding to the magic neutron shells. (auth)

17059 GAMMA RAYS FROM THE REACTION $^{29}Si(p,\gamma)^{30}P$. Hiroyasu Ejiri, Yutaka Nakjima, Kinuko Horie, Shinji Matsumoto, and Yozo Nogami (Tokyo Univ.). Nucl. Phys., 51: 470-80(Feb. 1964).

Thin ^{29}Si targets were bombarded with protons in the energy range 1–1.4 Mev and gamma rays were investigated at the proton resonance energies 1.309 and 1.333 Mev using sodium iodide scintillation counters. The two resonant levels correspond to the excited states in ^{30}P at 6.835 ± 0.03 and 6.86 ± 0.03 Mev, respectively. Estimated values of spins, parities, isobaric spins and reduced gamma radiation widths were $J^\pi = 1^+$, T = 0, $\Gamma_\gamma = 0.21 \pm 0.05$ ev for the 6.835 Mev state and $J^\pi = 2^+$, T = 1, $\Gamma_\gamma = 0.28 \pm 0.05$ ev for the 6.86 Mev state. The Q value of the reaction was measured to be Q = 5.57 ± 0.03 Mev. Most of the gamma ray transitions from the resonant levels are in accord with the isobaric spin selection rule for self-conjugate nuclei. A gamma transition, which is forbidden by the same selection rule, was also observed. This may be accounted for in terms of the isobaric spin impurity in the excited state. (auth)

17060 AN INVESTIGATION OF THE C^{12} + He^3 REACTIONS AT BOMBARDING ENERGIES BETWEEN 1.8 AND 5.4 Mev. Hsin-min Kuan, T. W. Bonner, and J. R. Risser (Rice Univ., Houston, Tex.). Nucl. Phys., 51: 481-517 (Feb. 1964). (TID-19462)

The differential cross sections at several angles and some angular distributions of the following outgoing radiations induced by He^3 in C^{12} targets from 1.8 to 5.4 Mev were measured; elastic He^3, proton groups corresponding to the formation of the N^{14} ground state and excited states at 2.311, 3.945, 4.91, 5.10, 5.69, 5.83, 6.23, 6.44, and 7.03 Mev (p_0 to p_4, p_8, p_9, and p_{11}), the 6.44 Mev gamma rays ($\gamma_{6.44}$) following the p_9 group, and the α groups corresponding to the formation of the C^{11} ground state and the first excited state at 2.00 Mev. Proton groups to N^{14} states at 6.05 and 6.70 Mev (p_7 and p_{10}) were not observed. Both the p_9 and the corresponding $\gamma_{6.44}$ show a strong isolated resonance at 2.990 ± 0.010 Mev with Γ_{lab} = 125 ± 10 kev. Analyses at this resonance on the elastic He^3, p_9, $\gamma_{6.44}$, p_1 and n_0 data, assuming pure compound nucleus formation as the reaction mechanism, yielded $J^\pi = 5/2^+$ for the corresponding state in O^{15*} at 14.46 Mev and even parity for the 6.44 Mev state of the residual nucleus N^{14}. Indications of resonances at 2.45 ± 0.04, 2.75 ± 0.04, 3.28 ± 0.04, 3.60 ± 0.04, 4.20 ± 0.01, 4.37 ± 0.04, 4.6 ± 0.1, and 5.0 ± 0.1 Mev, corresponding to the states in O^{15} at 14.03, 14.27, 14.69, 14.95, 15.43, 15.57, 15.75, and 16.07 Mev were also observed. (auth)

17061 EXCITATION FUNCTION OF THE $N^{14}(p,n)O^{14}$ TOTAL CROSS SECTION FROM THRESHOLD TO 12 Mev. Hsin-min Kuan and J. R. Risser (Rice Univ., Houston, Tex.). Nucl. Phys., 51: 518-27(Feb. 1964). (TID-19455)

The excitation function of the total $N^{14}(p,n)O^{14}$ cross section from threshold to 12 Mev was obtained by measuring the activation of O^{14}. The threshold was determined to be 6.345 ± 0.015 Mev. The excitation function rises smoothly from threshold up to about 8 Mev and then stays nearly constant up to 12 Mev, with indication of resonances at 7.5, 7.7, 7.95, 8.20, 9.05, 9.4, and 9.85 Mev. The 9.85-Mev resonance is relatively more pronounced than the others and has Γ_{lab} = 600 ± 100 kev. Corresponding resonances in C^{12} + He^3 and N^{14} + p due to the same states in O^{15} are evident. Using the same experimental arrangement the excitation function of the total $C^{12}(He^3,n)O^{14}$ cross section from threshold to 3.5 Mev was also measured. (auth)

17062 MULTIPLE COULOMB SCATTERING FOR VERY-HIGH-ENERGY PARTICLES. Prem K. Aditya (Indian Inst. of Tech., New Delhi). Nuovo Cimento (10), 31: 473-84(Feb. 1, 1964).

The multiple scattering of 27 Bev protons was carried out to obtain the lateral distribution up to 10 cm length in emulsions. The influence of spurious scattering was made negligible. The scattering is found to be about 15% lower than that predicted theoretically. The value of the scattering constant for cell lengths in the region 3 cm to 10 cm was determined as K = 27.6 ± 1.3. (auth)

17063 THEORY OF THE COULOMB PHOTOPRODUCTION OF π^0 AT HIGH ENERGY AND THE DETERMINATION OF THE π^0 LIFETIME. G. Morpurgo (Università, Geneva and Istituto Nazionale di Fisica Nucleare, Geneva). Nuovo Cimento (10), 31: 569-98(Feb. 1, 1964).

The angular dependence of the cross section for the coherent photoproduction of π^0 on complex nuclei (Primakoff effect) is studied in detail in connection with the problem of determining the π^0 lifetime. The effects of reabsorption of the photoproduced π^0 on the angular distribution are calculated with the use of an optical model of the nucleus. It is shown that consideration of these effects is essential for establishing the angular dependence of the coherent nuclear matrix element and is also important for the Coulomb matrix element; it is also shown that in both cases these absorption effects can be written as a modification of the nuclear form factor. The modified form factors are calculated for lead at a photon energy of 1 Bev, assuming, for simplicity, a uniform spherical distribution of the nucleus. Three results of this calculation can be noted: both the modified nuclear and Coulomb form factors become complex quantities, although in the situation considered their imaginary part is generally an order of magnitude smaller than their real part; the absolute value of the modified nuclear form factor is depressed with respect to the value of the form factor calculated without taking the absorption into account by a factor that varies between 2 and 3 in the angular region of interest; and at angles larger than ~2° the modified Coulomb form factor also differs considerably from the no absorption form factor. Assuming that the nuclear shape and radius are known and relying on the above mentioned calculation of the form factors, the differential photoproduction matrix element can be written in terms of three (angle independent) parameters; one is the lifetime τ to be determined and the other two are the real and imaginary part of a certain combination η of the forward non-spin-flip complex amplitudes for π^0 photoproduction on a nucleon. It is pointed out that while the present data on π^0 photoproduction on a proton can, at best, only determine an upper limit to $|\eta|$, the coherent photoproduction data in the region $0° < \theta < 6°$ should allow an easy determination of the value of $|\eta|$, that is of the relative magnitude of the Coulomb and nuclear coherent matrix element. Only after this important parameter is known, it will be possible to decide if the lifetime of the π^0 can be determined using only the data at small angles $0 < \theta < 1.5°$ or if it will be necessary to perform a complete three-parameter best fit using the obtained results. (auth)

17064 ISOTOPIC SHIFT IN X-RAY SPECTRA. F. A. Babushkin. Opt. Spectry. (USSR) (English Transl.), 15: 393-4(Dec. 1963).

A formula was obtained for the isotopic shift of x-ray lines. Values were computed for the isotopic shift of the $1s_{1/2}$ state, taking account of the compressibility and deformability of atomic nuclei. (auth)

17065 EFFECT OF AN ELECTRIC FIELD ON THE NMR IN GASES AND LIQUIDS. A. M. Vasil'ev and V. M. Evdokimov. Opt. Spectry. (USSR) (English Transl.), 15: 419-23(Dec. 1963).

A quantum mechanical calculation of the magnitude of the magnetic resonance spectrum splitting in an external electric field is given. It is assumed that the nucleus has a nonzero quadrupole moment and is part of a molecule with an electric dipole moment. The possibility of experimentally measuring the effect for the purpose of determining the quadrupolar coupling constant is discussed. (auth)

17066 SPIN AND NUCLEAR MOMENTS OF Hg^{203}. O. Redi and H. H. Stroke (Massachusetts Inst. of Tech., Cambridge). Phys. Letters, 8: 257-9(Feb. 15, 1964).

The spin of Hg^{203} was determined by optical spectroscopic measurements of the splittings in a magnetic field and of the zero-field position of the Hg^{203} hyperfine structure components in the 2537 and 4047 Å lines. The magnetic field splitting measurements were analyzed with the IBM 7090 computer program, Hyperfine III, and curves showing the results of the analysis are given. The spin measurements yielded $I = 5/2$, and the magnetic moment calculation yielded μ = 0.46 nm. (L.B.S.)

17067 ENERGETICS OF FISSION OF Th^{232} INDUCED BY 27.8 Mev HELIUM IONS. M. Seki, A. Katase, M. Sonoda, A. Yoshimura, Ts. Akiyoshi, and S. Yamawaki (Kyushu Univ., Fukuoka). Phys. Letters, 8: 263-5 (Feb. 15, 1964).

A back-to-back solid state detector system was used to study the energetics of 27.8-Mev helium ion-induced fission of Th^{232}, an ion beam of 0.05 μa in intensity being used from the I.N.S. cyclotron. A symmetric peak observed in the kinetic energy contour diagram is reported. The mass yield and the average total kinetic energy curves, derived from the contour diagram, are presented. (L.B.S.)

17068 THE SPINS AND MOMENTS OF Ag^{108} AND Cu^{66}. G. K. Rochester and K. F. Smith (Univ. of Sussex, Eng.). Phys. Letters, 8: 266(Feb. 15, 1964).

The spins and magnetic moments of Ag^{108} and Cu^{66} were measured using an atomic beam magnetic resonance apparatus. The results of simple shell-model moment calculations, based on published proton and neutron states for the odd-odd nuclei Cu^{64}, C^{66}, and Ag^{108}, are tabulated and compared with experimental values. (L.B.S.)

17069 SEARCH FOR WIGNER CUSP IN F^{19} TOTAL NEUTRON CROSS SECTIONS. W. E. Meyerhof (Stanford Univ., Calif.). Phys. Letters, 8: 267-8(Feb. 15, 1964).

Analysis of curves of the total neutron cross sections of F^{19} as a function of energy shows the expected Wigner cusps near the inelastic threshold for excitation of the 110-kev, $\frac{1}{2}^-$ state. (L.B.S.)

17070 INELASTIC SCATTERING OF 155 Mev PROTONS ON LIGHT NUCLEI. J. C. Jacmart, J. P. Garron, M. Riou, and C. Ruhla (Faculte des Sciences, Orsay, France). Phys. Letters, 8: 269-72(Feb. 15, 1964). (In French)

The angular distributions of inelastically scattered 155-Mev protons from excited states of Li^6, Li^7, Be^9, B^{10}, B^{11}, C^{12}, and Ca^{40} are measured. The measurements are used to determine the angular momentum, parity, excitation probability, etc. for these excited states. (T.F.H.)

17071 INELASTIC SCATTERING OF 155 Mev PROTONS ON Na^{23}, Al^{27}, P^{31}, K^{39}, Ti^{48}, Cr^{52}, Fe^{56}, AND Co^{59}. J. C. Jacmart, M. Liu, R. A. Ricci, M. Riou, and C. Ruhla (Faculte des Sciences, Orsay, France). Phys. Letters, 8: 273-6(Feb. 15, 1964). (In French)

The properties of energy levels of Na^{23}, Al^{27}, P^{31}, K^{39}, Ti^{48}, Cr^{52}, Fe^{56}, and Co^{59} are studied. The excitation of these levels is accomplished by inelastic scattering of 155-Mev protons, and the properties of the energy levels are determined by analyzing the angular distributions of the scattered protons. (T.F.H.)

17072 ANALYSIS OF FLUCTUATIONS OF INTEGRATED CROSS-SECTIONS FROM $Al^{27}(d,\alpha)Mg^{25}$ REACTIONS. Y. Cassagnou, I. Iori, C. Levi, M. Mermaz, and L. Papineau (Centre d'Etudes Nucléaires, Saclay, France). Phys. Letters, 8: 276-8(Feb. 15, 1964).

The excitation functions of several α groups from the reaction $Al^{27}(d,\alpha)Mg^{25}$ between 4.50 and 5.62 Mev were measured for statistical analysis to test the predictions of Ericson's theory of fluctuations of integrated cross sections. Angular distribution curves are presented. Curves of the excitation functions were analyzed in terms of correlation functions and probability distribution. (L.B.S.)

17073 NONEXISTENCE OF COLLECTIVE M1 TRANSITIONS. P. O. Lipas (Univ. of Helsinki). Phys. Letters, 8: 279-81(Feb. 15, 1964).

It is shown that the collective M1 transitions predicted by the Davydov-Fillipov model are strictly forbidden, and the effective part of the M1 operator is the result of inconsistent use of different orders of magnitude. (L.B.S.)

17074 EXCHANGE MAGNETIC MOMENT IN THREE BODY NUCLEI. W. M. Frank (Naval Ordnance Lab., Silver Spring, Md.) and D. W. Padgett. Phys. Letters, 8: 281-2(Feb. 15, 1964).

The contribution of meson exchange to the magnetic moment in H^3 and He^3 was calculated. Meson exchange diagrams and a table of the exchange moments as a function of interparticle hard core cutoff are given. (L.B.S.)

17075 WEAKLY COUPLED VIBRATIONS OF A $f_{\frac{7}{2}}$-PARTICLE. Y. Waghmare and H. P. Kelly (Univ. of California, La Jolla). Phys. Letters, 8: 283-4(Feb. 15, 1964).

A qualitative survey of the vibrations of a $f_{\frac{7}{2}}$-particle in the region N or Z = 21 to 27 was made using the Bohr-Mattleson model. In accord with the interaction hamiltonian, the odd-A nucleus was treated as constituting an even-even core and the last particle being subjected to quadrupole vibrations. Calculations of the low-lying energy levels were made with the use of a 3-phonon approximation and values of the coupling parameters and phonon energy of neutrons and protons in the $f_{\frac{7}{2}}$ shell. Agreement was found between theory and experimental results, as shown in energy level diagrams of the various nuclei. (L.B.S.)

17076 NUCLEAR MAGNETIC RELAXATION OF THREE SPIN SYSTEMS UNDERGOING HINDERED ROTATIONS. Richard L. Hilt and Paul S. Hubbard (Univ. of North Carolina, Chapel Hill). Phys. Rev., 134: A392-8 (Apr. 20, 1964).

The longitudinal nuclear magnetic relaxation of an ensemble of spin systems exposed to a constant magnetic field H_0k is calculated. Each spin system consists of three identical spin-$\frac{1}{2}$ nuclei located at the vertices of an equilateral triangle. Each spin system undergoes hindered rotation about an axis that is perpendicular to the plane of the three spins, and is oriented at an angle β with the constant field. Two models for the rotation are studied: In one model there are only three possible equilibrium orientations of each system about its rotation axis and the group makes random jumps between these orientations; in the other model each group performs stochastic rotational diffusion about its rotation axis. Both models lead to results of the same form, which differ only in the definition of the correlation time τ_c of the motion. It is assumed that the relaxation is due to the magnetic dipole-dipole interactions between the nuclei within each group. The calculation is performed by use of the semiclassical form of the density operator theory of relaxation. The treatment includes terms arising from the cross correlation of different dipole-dipole interactions with one another, from the nonzero average of the dipole-dipole interactions, and from the second-order correction to the Zeeman energy due to the dipole-dipole interactions. The relaxation is, in general, the sum of four decaying exponentials. For $\beta = 0$, the relaxation does not decay to zero. By use of an electronic computer, explicit solutions have been calculated for $\cos\beta = 0, \pm 0.1, \pm 0.2, \ldots, \pm 1.0$ for many values of the correlation time. Also, explicit solutions have been calculated for situations in which the axes of hindered rotation are isotropically oriented. All results are compared with the results of a calculation in which cross correlations are omitted, and are shown to differ significantly. The results are presented in a form which

can be compared with experimental data, and used to determine the correlation time of the hindered rotations. (auth)

17077 ANOMALOUS NUCLEAR MAGNETIC RESONANCE LINEWIDTH IN LITHIUM. David Zamir (Cornell Univ., Ithaca, N. Y.), R. C. Wayne, and R. M. Cotts. Phys. Rev. Letters, 12: 327-30(Mar. 23, 1964).

It is shown that the anomalous decrease in the transverse relaxation time, T_2, observed in lithium is largely due to effects of self-diffusion in the large magnetic field gradients used in the nuclear magnetic resonance experiments. The measurements of T_2 in lithium by the two-pulse spin-echo technique were found to be in agreement with published values. (L.B.S.)

17078 EVIDENCE FOR FLUCTUATING AND DIRECT CONTRIBUTIONS TO NUCLEAR REACTION CROSS SECTIONS. G. M. Temmer (Rutgers Univ., New Brunswick, N. J.). Phys. Rev. Letters, 12: 330-3(Mar. 23, 1964).

Fluctuation analyses of the data on the reactions $Al^{27}(p,\alpha)Mg^{24}$, leading to five low-lying states of Mg^{24}; $Co^{59}(p,\alpha)Fe^{56}$, leading to the first three excited states of Fe^{56}; and $F^{19}(p,\alpha)O^{16}$ were made. Illustrations of probability distributions for the reactions are given in the form of histograms. (L.B.S.)

17079 MULTIPARTICLE EXCITATIONS IN THE INTERMEDIATE COMPOUND STATE. A. Lande and B. Block (Princeton Univ., N. J.). Phys. Rev. Letters, 12: 334-6 (Mar. 23, 1964).

The systematics for the occurrence of multiparticle excitations for incident neutrons and protons on even nuclei in the region $16 \leq A \leq 146$ are explored. The results are discussed for neutron-neutron proton-proton and neutron-proton interactions. Tables showing the multipole components of the residual potential used to excite the 2p1h and 3p2h states are given for incident neutrons and protons. (L.B.S.)

17080 THE $^{30}Si(p,\gamma)^{31}P$ REACTION FOR BOMBARDING ENERGIES BETWEEN 1.00 AND 1.53 Mev. H. Van Rinsvelt (Institut Interuniversitaire des Sciences Nucleaires, Brussels) and P. B. Smith. Physica, 30: 59-83(Jan. 1964).

Eighteen resonances were identified as belonging to the $Si^{30}(p,\gamma)P^{31}$ reaction for proton bombarding energies between 1.00 and 1.53 Mev. The gamma yield of the corresponding excited states of P^{31} was measured, and the principal features of the decay were determined. Double and/or triple angular correlations of the decay radiation were measured at seventeen of the resonances, resulting in unique spin assignments in all cases. Conclusions on parity were drawn in some cases from the multipole mixing ratios of the capture radiation or from the reduced proton width. The quadrupole-dipole mixing ratio in the decay of the first excited state was determined as 0.28 ± 0.02. It is proved that the mixing ratio determination in this case is ambiguous if only intensity-direction correlation measurements are made. The unique result stems partly from other methods of measurement. A corollary to the theorem mentioned, relating to the first gamma ray in a cascade, is also given. The spin of the fifth excited state of P^{31} is found to be $^7/_2$, and, in disagreement with others, it was established that the branching ratio of a possible ground-state decay of this level is not more than 1%. The unexpectedly large number of close-lying doublets found in this bombarding energy region is discussed. A resonant absorption measurement at the doublet at $E_p = 1480.7$ and 1482.2 kev demonstrated the predicted array of one central absorption dip, and two satellite dips. (auth)

17081 TOTAL CROSS SECTION FOR SCATTERING OF COLD NEUTRONS BY PROTONS IN SOME COOLED HYDROGENOUS COMPOUNDS. W. Van Dingenen and M. Neve de Mevergnies (Centre d'Etudes Nucléaires, Mol, Belg.). Physica, 30: 237-43(Jan. 1964).

Total neutron cross sections were measured for some hydrogenous compounds (acetylene, ammonia, methane) condensed at different low temperatures, and for neutron wavelengths between 1 and 12 Å. From the variation of the neutron cross section as a function of temperature and neutron wavelength some information is derived about the dynamical behavior of the bound protons. An interpretation of the results is tried in terms of an effective Debye temperature characterizing each moderator. For solid ammonia the Debye-model fits rather well, but for methane it seems inadequate. There appears to be a good correlation between the values obtained for the inelastic scattering cross section, and the results of earlier measurements on the output of cold neutron sources. (auth)

17082 SPURIOUS STATES IN THE QUASI-PARTICLE APPROXIMATION. R. Balian (Centre d'Etudes Nucleaires, Saclay, France) and J. Hoegaasen. Proc. Phys. Seminar Trondheim, No. 1, 7p.(1964).

It is shown how spurious states in the quasi-particle approximation may be systematically eliminated. A wave function for the ground state of an n-particle system in the quasi-particle approximation is used in the formalism. (C.E.S.)

17083 HYPERFINE STRUCTURE OF PuI. J. Bauche and B. R. Judd (C.N.R.S., Bellevue, France). Proc. Phys. Soc. (London), 83: 145-56(Jan. 1964).

A theoretical analysis is given of the hyperfine structures of the levels of the multiplet ^7F of Pu I $5f^67s^2$. Allowance is made for the effects of intermediate coupling. It is found that the results are consistent with a value of $+0.17 \pm 0.04$ nuclear magnetons for the nuclear moment of Pu^{239}, provided a term representing the polarization of the core is included. The calculated moment is in good agreement with previous measurements on Pu II $5f^67s$; furthermore, the magnitude of the core polarization is consistent with that required to account for the anomalous atomic-beam results for Am I $5f^77s^2\ ^8S_{7/2}$. (auth)

17084 PAIRING CORRELATIONS IN FINITE SYSTEMS. B. H. Flowers and J. M. Irvine (Univ. of Manchester, Eng.). Proc. Phys. Soc. (London), 83: 335-53(Mar. 1964).

The Bardeen–Cooper–Schrieffer wave function suffers from the drawback, particularly restrictive in systems containing few fermions, that it fails to conserve particle number. In the case of a nucleus it is also difficult to conserve spin and isobaric spin. A variational wave function is proposed that, by allowing for the explicit excitation of pairs, conserves particle number, and it is shown that an energy gap results when pairing forces act between the particles. Many of the features characteristic of the Bardeen–Cooper–Schrieffer treatment can be reproduced for a finite system even when the excitation of only one pair is allowed. In a more general form the wave function can be used to describe neutrons and protons interacting through charge-independent forces. A preliminary estimate is made by these means of the purity of the closed-shell structure of the O^{16} ground state in the presence of pairing forces. (auth)

17085 LIFETIME OF THE FIRST EXCITED STATE IN ^{160}Dy. M. Dorikens (Rijksuniversiteit, Ghent), L. Dorikens-Vanpraet, J. Demuynck, and O. Segaert. Proc. Phys. Soc. (London), 83: 461-4(Mar. 1964).

The half life of the first excited state of Dy^{160} was measured by the delayed gamma–gamma coincidence technique, using NE 102 plastic scintillator detectors. A nonlinear least-square analysis was calculated using an IBM 1620 computer. The measurements showed a value of $T_{\frac{1}{2}} = (1.89 \pm 0.05) \times 10^{-9}$ sec. The nuclear deformation parameter is $\beta = 0.33$; the enhancement was found to be 171 with respect to the transition probability in terms of the single-particle model. (auth)

17086 HALF-LIFE DETERMINATION OF ^{220}Rn. J. E. Gindler and D. W. Engelkemeir (Argonne National Lab., Ill.). Radiochim. Acta, 2: 58-62(Dec. 1963).

The half life of ^{220}Rn was measured by a new technique. Radon atoms were embedded firmly in stainless steel plates by the collection in vacuum of recoiling atoms from a thin source of ^{224}Ra. The activity on these plates was counted in a proportional counter using a 400-channel analyzer as a multiscaler. The average half life obtained for eleven determinations was 55.3 ± 0.3 seconds. A discussion of some of the errors possible in the various methods of measuring the radon half-life is presented. (auth)

17087 ON THE PROBABILITY OF $\mu^- + Li^6 \rightarrow He^6 + \nu$ REACTION. Chêng-jui Ching (Peking Univ.). Sci. Sinica (Peking), 13: 337-8(Feb. 1964). (In Russian)

The probability rate for the reaction $\mu^- + Li^6 \rightarrow He^6 + \nu$ was determined to be 1.06×10^3 sec^{-1}. (C.E.S.)

17088 CONTRIBUTION TO THE THEORY OF NUCLEAR REACTIONS. Yu. V. Tsekhmistrenko (Inst. of Physics, Kiev). Ukr. Fiz. Zh., 8: 1287-1302(1963). (In Ukrainian)

A theory of nuclear reactions depending on time is constructed. The initial condition is given at a finite moment of time. By means of simple and indisputable physical considerations and the peculiarities of mathematical formalism, the introduction of the adiabatic hypothesis or the equivalent mathematical principle of Brenig and Haag or Gell-Mann, Goldberger is avoided. The amplitude of transition (equal in S-matrix theory to the T-matrix) is expressed linearly through an auxiliary amplitude $g^{(3)}$. The auxiliary operator H_0 enters into the theory. The arbitrariness in its choice may be used to obtain a sufficiently good result at the very first stage of the developed regular iteration method. For reactions with rearrangement of particles a formula is obtained in the first approximation differing from those ordinarily applied; the derivation of this formula is free from the shortcomings of the ordinary derivation. It is shown that the amplitude of transition is expressed through a full Ψ-function of the system, as in the S-matrix theory; hence, all results in the theory that follow from the theorem of reciprocality and unitarity hold true. (auth)

17089 ELASTIC SCATTERING OF NEUTRONS WITH ENERGY 0.65 Mev BY ATOMIC NUCLEI. I. A. Korzh, N. S. Kopytin, M. V. Pasechnik, N. M. Pravidivi, N. T. Sklyar, and I. A. Totskii (Inst. of Physics, Kiev). Ukr. Fiz. Zh., 8: 1323-7(1963). (In Ukrainian)

A method using spherical scatterers was chosen for the measurement of the angular distributions of elastically scattered neutrons. The neutron source was a tritium-zirconium target irradiated by a beam of protons accelerated by an electrostatic generator (reaction $T(p,n)He^3$). To exclude the effect of inelastic scattering a threshold detector was used. Results are presented of measurements of angular distributions of elastically scattered neutrons with energy 0.65 Mev by atomic nuclei of Al, Ni, Zn, Zr, Ag, Sn, Te, Ba, Hg, and Pb in the range of angles from 30 to 140°. The integral sections of elastic and inelastic scattering, the average value of the cosine of the angle of elastic scattering of neutrons, and transport cross sections are calculated by the data of angular distributions. Corrections for the decrease of the detector sensitivity to neutrons scattered by an angle Θ and to multiple scattering neutrons in the sample were introduced into the calculated values of the differential sections of elastically scattered neutrons. (auth)

17090 ANGULAR DISTRIBUTIONS OF NEUTRONS WITH ENERGY 0.3 Mev ELASTICALLY SCATTERED ON ATOMIC NUCLEI. I. A. Korzh and N. T. Sklyar (Inst. of Physics, Kiev). Ukr. Fiz. Zh., 8: 1389-91(1963). (In Ukrainian)

Angular distributions for neutron elastic scattering by Na, Mg, Al, K, Fe, Ni, Zn, Cd, Sn, Te, and Hg at 0.3 Mev were determined. The scattering cross sections were also presented. (C.E.S.)

17091 MEASUREMENT OF THE ABSOLUTE DIFFERENTIAL CROSS SECTION FOR PROTON GROUPS FROM THE REACTION $Al^{27}(d,p)Al^{28}$. K. I. Zherebtsova, V. F. Litvin, Yu. A. Nemilov, and Chien Chang. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 63-7(1963). (In Russian)

A new method for nuclear reaction cross section determination, based on multi-angle magnetic analysis of reaction products, is presented. The reaction $Al^{27}(d,p)Al^{28}$ is investigated; the absolute cross sections are in agreement with previous data. New evidence on angular momenta transfer l_n and absolute reduced width θ^2 for the 5.435-Mev level of Al^{28} are obtained. (auth)

17092 INVESTIGATION OF (d,p) REACTIONS AND ELASTIC SCATTERING (d,d) ON NUCLEI WITH INTERMEDIATE ATOMIC WEIGHT. PART I. INVESTIGATION OF REACTIONS (d,p) AND (d,d) ON CHROMIUM ISOTOPES Cr^{50}, Cr^{52}, Cr^{53}, AND Cr^{54}. V. P. Bochin, K. I. Zherebtsova, V. S. Zolotarev, V. A. Komarov, V. F. Litvin, Yu. A. Nemilov, and Sh. Piskorzh. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 68-77(1963). (In Russian)

Angular distributions of many proton groups from (d,p) reactions on isotopic targets Cr^{50}, Cr^{52}, Cr^{53}, and Cr^{54} are studied. In addition to previously known levels, 48 new levels are investigated. Angular momentum transfer l_n and absolute reduced width θ^2 for most of them are also obtained. A single-particle reduced with $(\theta_0^2)_{2p}$ for 2p-shell is found experimentally. With the help of the value of single-particle reduced width an estimate of neutron hole numbers in the 2p-shell nuclei is made. (auth)

17093 INVESTIGATION OF (d,p) REACTIONS AND ELASTIC SCATTERING (d,d) ON NUCLEI WITH INTERMEDIATE ATOMIC WEIGHT. PART II. INVESTIGATION OF REACTIONS (d,p) AND (d,d) ON IRON ISOTOPES Fe^{54}, Fe^{56}, AND Fe^{57}. V. P. Bochin, K. I. Zherebtsova, V. S. Zolotarev, V. A. Komarov, L. V. Krasnov, V. F. Litvin, Yu. A. Nemilov, and B. G. Nobatskii. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 78-84(1963). (In Russian)

Angular distributions of many proton groups from (d,p) reactions on isotopic targets Fe^{54}, Fe^{56}, Fe^{57} are studied. 76 levels of corresponding final nuclei are investigated. In addition to previously known, 27 new values of angular momentum transfer l_n and absolute reduced width are obtained. A sharp dependence of absolute cross sections on the symmetry parameter is established. An evaluation of neutron hole numbers in 2p-shell nuclei is carried out. Isobar-spin term in nuclear optical potential is estimated as well. (auth)

17094 β_0 COMPONENT IN Pb^{210} DECAY. I. M. Rogachev, V. P. Chechev, and G. C. Katykhin. Vestn. Leningr. Univ., No. 22, Ser. Fiz. i Khim., No. 4, 92-6(1963). (In Russian)

The decay of Pb^{210} was studied by the magnetic lens β spectrometer with intermediate acceleration. The energy limit of the β_0-component was found to be $E_{\tau\beta_0} = (61.0 \pm 1.3)$ kev and its intensity was $J_{\beta_0} \leq (19 \pm 2)\%$; other characteristics of the decay of Pb^{210} were defined as well. (auth)

17095 ON THE g_R FACTOR OF NUCLEI. Kuo-shen Yang (Tientsin Coll. of Engineering, China). Wu Li Hsueh Pao, 19: 771-81(Dec. 1963). (In Chinese)

A general formula for the g_R factor is derived in accordance with Skyrme's variational method. Numerical values of g_R for Yb^{172}, Yb^{173}, Yb^{174}, Lu^{175}, Hf^{176}, Hf^{177}, Hf^{178}, Hf^{179}, and Hf^{180} are obtained using Nilsson's wave functions. The calculated values of g_R depend on the discrepancy of the spin-orbit coupling parameter x between the neutron and the proton. They are near to the observed values, smaller than Z/A and greater than those of the cranking model with pair-correlation interaction taken into account. (auth)

17096 RADIOAKTIVNYE PREVRASHCHENIYA YADER I ATOMNAYA OBOLOCHKA. (Radioactive Transmutation of Nuclei and Atomic Shells). S. V. Starodubtsev and A. M. Romanov. Tashkent, Publishing House of the Academy of Sciences, 1958. 495p.

Radioactive transmutations of nuclei and atomic shells including beta decay, alpha decay, gamma radiation from isomeric states, and nuclear fission are discussed. The characteristics of nuclei and nuclear levels, the role of atomic shells in radioactive transmutation processes, investigation of emission spectra and correlations for beta transitions, the excitation and ionization of atoms during beta transitions, and ionization of atoms during alpha decay and nuclear fission are considered. A bibliography of 523 references is included. (C.E.S.)

17097 LEGCHAISHIE ATOMNYE YADRA. (The Lightest Atomic Nuclei). A. N. Vyal'tsev. Moscow, Publishing House of the Academy of Sciences, 1963. 334p.

The discovery and the determination of the properties of the proton, neutron, deuteron, triton, helion, and alpha particle are reviewed. Mass and binding energy, statistics and spin, magnetic dipole moments, electric quadrupole moments, and radioactivity are discussed. Over 500 references are listed. (C.E.S.)

17098 ELECTRONS AND ACTIVE NITROGEN. B. Brandt (Universität, Bonn). p.43-4 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gas. Vol. I." Paris, SERMA, 1963.

Measurements indicated that in all nitrogen discharges dissociation and recombination is due to electrons and the degree of dissociation is a function of the electron temperature alone. (auth)

17099 SKHEMY RASPADA RADIOAKTIVNYKH YADER A ≥ 100. (Decay Schemes of Radioactive Nuclei A ≥ 100). B. S. Dzhelepov, L. K. Peker, and V. O. Sergeev. Moscow–Leningrad, Publishing House of the Academy of Sciences, 1963. 1060p.

Data on the decay schemes of radioisotopes from Nb^{100} to Lw^{257} are presented. Tables of spin values, magnetic dipole moments, electric quadrupole moments, electron binding energies, and cross sections for thermal neutron activation are included. Numerous references are cited for each isotope. (C.E.S.)

17100 STATISTICAL THEORY OF FISSION AND KINETIC ENERGY DISTRIBUTION. Peter Fong (Cornell Univ., Ithaca, N. Y.). 9p. (CONF-346-8)

From International Conference on Nuclear Physics with Reactor Neutrons, Argonne, Ill., Oct. 1963.

The statistical theory of fission is discussed for mass distributions, kinetic energy of fission products, and prompt neutron distributions. Calculations are compared with statistical theory for neutron fission of U^{235}, deuteron fission of Ra^{226}, and spontaneous fission of Cf^{252}. (R.E.U.)

17101 GAMMA RAYS FROM A 14.4 Mev LEVEL IN Be^9. G. M. Griffiths (California Inst. of Tech., Pasadena). 6p. (CONF-417-4)

From American Physical Society Meeting, Pasadena, Calif., Dec. 1963.

Measurements were made on the gamma energies from Be^9 produced in the reaction $Li^7(He^3,p)Be^9$. For bombarding energies above 4.6 Mev there is a yield of 12 and 14.5-Mev gamma rays; since the threshold for forming Be^9 in a level at 14.39 Mev is at 4.56 Mev, the gamma rays were attributed to the decay of the 14.39-Mev state to the ground and first excited states. The gamma yield is not a monotonic function of bombarding energy, for the yield at 6.5 Mev is higher than at 5.5 or 7.5 Mev. Angular distributions of the gamma rays were measured from 30 to 140° and to within 25% the yield of 12 and 14.5 Mev gamma rays is isotropic. (P.C.H.)

Plasma Physics and Thermonuclear Processes

17102 (AD-431025) ON THE SOLVABILITY OF THE BOGOLIUBOV KINETIC THEORY FOR PLASMAS. Technical Report No. 1. R. C. Mjolsness (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). Dec. 30, 1963. Contract Nonr-4188(00). 36p.

The conditions are determined under which the Bogoliubov kinetic equations for spatially homogeneous, multicomponent plasmas with and without a homogeneous external magnetic field can be solved. (D.C.W.)

17103 (ARL-64-6) RESEARCH ON PLASMA DIAGNOSTIC METHODS FOR HIGH-TEMPERATURE PLASMA RESEARCH. Arwin A. Dougal (Texas. Univ., Austin). Jan. 1964. Contract AF33(657)-11073. 52p. (AD-432170)

Laboratory development of a far infrared radiation detection system for plasma diagnostics is summarized. The detection capability of the indium–antimonide infrared detector which is now available for the 0.05 to 4 mm wavelength range is evaluated analytically. Bremsstrahlung emission from high temperature plasma for frequencies above the plasma frequency is evaluated. Black body radiation in a finite band at wavelengths from 0.6 to 4 mm is evaluated. The signal-to-noise ratio is found to be favorable for the higher emissions. The design and experimental arrangement of an electrostatic ion energy analyzer is presented. A Penning discharge source is planned to serve as a calibration source which is collimated with well-defined ion energies. Experimental research on plasma diagnostics of an extreme temperature plasma source is reported. A 1.5 Mc, 1800 gauss peak, preheating δB_z field induces a δE_θ greater than 200 volts/cm in hydrogenic plasma previously partially ionized and immersed in a slowly rising reverse B_{zo} bias field. Time resolved energy deposition during this 50 megawatt preheating is determined from the damped coil current waveform. Deposition increases for higher bias fields at onset of pulsed preheating up to some critical value near 1800 gauss where deposition abruptly ceases. This critical bias field depends on the initial pressure and electron density.

Temperatures to 1-10 ev measured after preheating are correlated with energy deposition. Kerr cell photographs were taken at 0.1 μs intervals during the first two cycles of the preheating. In the first half-cycle intense ionization commences when $\delta B_z + B_{z0}$ decreases to approximately 100 gauss. A luminous ring sweeps inward 1–10 cm/μs with appreciable deposition for higher bias fields but remains nearly stationary at the periphery with less deposition for low bias fields. Internal magnetic probe measurements correlate with the photographs. An analysis of electron motions, including an E_r field arising from E_θ/B_z drifts, explains the onset of intense ionization and energy deposition. The measurement of the Faraday rotation of the electric vector of a linearly polarized optical maser beam propagated through a magnetoplasma parallel to the direction of the magnetic field is of interest to determine the plasma electron density. An experimental arrangement is evaluated analytically for the Faraday rotation measurement. The experimental arrangement consists of a helium-neon gas phase optical maser, extreme temperature plasma tube, beam splitting mirror, polarization analyzer, and a narrow band optical filter with multiplier tubes. Calculation of plasma bremsstrahlung radiation in a bandwidth of 50 Å about 6328 Å falling on an area equal to the area of the optical maser beam at one meter from the plasma is shown to about 100 times less than the maser power. Theoretical considerations for extending the most familiar microwave diagnostic concepts into the coherent optical maser wavelength range are further developed. Analogous to the characteristics of a microwave cavity filled with ionized gas, the behavior of an optical resonator filled with ionized gas and excited with a coherent optical maser beam is investigated. Resonance frequency shifts of a Fabry-Perot optical interferometer filled with ionized gas are related to the optical resonator length and Q, maser wavelength, and electron density. Faraday rotation of polarized optical maser beams in ionized gas subjected to intense magnetic fields is evaluated and shown to be experimentally measurable. (auth)

17104 (ARL-250(Pt.II)) RESEARCH ON THE MICROSTRUCTURE OF THE MAGNETIC FIELD IN A PLASMA. PART II. ON THE MAGNETIC FIELD DISTRIBUTION AND ON THE FOKKER-PLANCK COEFFICIENTS IN A PLASMA. Final Summary Technical Report. G. Kalman (Israel Inst. of Tech., Haifa and Paris. Université, Orsay. École Normale Supérieure. Faculté des Sciences). Apr. 1962. Contract AF61(052)-177. 43p. (AD-283999)

A summary of earlier results pertaining to the calculation of the Fokker-Planck coefficients in a plasma is given. The contribution due to electrostatic interaction is explicitly evaluated. Then the distribution of the stochastic magnetic field is considered. A technique is developed to calculate the distribution of the field due to particles revolving in the combined externally imposed and stochastic field. (auth)

17105 (BSD-TDR-64-6) RADIANT ENERGY LOSS FROM A CESIUM-ARGON PLASMA TO AN INFINITE PLANE PARALLEL ENCLOSURE. Research Report No. 175. Michael A. Lutz (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Sept. 1963. Contract AF04(694)-33. 35p. (AD-431640)

An integral equation dependent on the spectral absorption coefficient is derived for the radiant energy flux to the wall of an infinite plane parallel enclosure. An approximate spectral absorption coefficient for any alkali metal vapor is found for both continuum and line radiation. Specific calculations are performed for a Cs–Ar mixture with a Cs atom density of 10^{16}/cc, an Ar pressure of 1 atmosphere, an Ar temperature of 2000°K, and electron temperatures of 2000, 2500, and 3000°K. The flux to the wall is then computed numerically for planes separately by 1 cm, 10 cm and 100 cm. Continuum, line, and total radiation losses are given for each of the nine cases treated. The magnitude of the results indicates that radiant energy losses are not to be neglected in practical calculations based on a two-temperature model. (auth)

17106 (IPPJ-17) UNIFIED THEORY OF RELAXATIONS IN PLASMAS. Taro Kihara and Osamu Aono (Nagoya, Japan. Univ. Inst. of Plasma Physics). Dec. 1963. 75p.

An exact, divergence-free theory of plasma kinetics unifying the collision and wave theories is reviewed. The rates of relaxations of distribution functions due to interactions between constituent particles are calculated. Several examples of relaxation are treated. (D.C.W.)

17107 (JÜL-145-TP) ANGEWANDTE MAGNETOHYDRODYNAMIK. HEFT 1. THEORETISCHE GRUNDLAGEN. (Applied Magnetohydrodynamics. Part 1. Theoretical Basis). T. Bohn and H. A. Claassen (Kernforschungsanlage. Institut für Technische Physik, Julich, Germany). Dec. 1963. 46p.

A review of the nonrelativistic basic equations of MHD (magnetohydrodynamics) including their boundary conditions and dimensionless parameters is presented. The change of Ohm's Law for weakly ionized gases in strong magnetic fields is discussed. By use of the basic equations some characteristic phenomena of MHD are shown and explained physically. (tr-auth)

17108 (NP-13609) RASCHET ZAPOLENENIYA PLAZMOI MAGNITNOI LOVUSHKI GVL-2. (Computation on the Filling of Magnetic Trap GVL-2 with Plasma). E. S. Borovik, F. I. Busol, and K. D. Sinel'nikov (Akademiya Nauk Ukr. S.S.R. Fiziko-Tekhnicheskii Institut, Karkov). 1963. 11p.

The design and specifications of the magnetic system and data on field distribution in the trap are given. The magnetic field consists of two liquid hydrogen cooled copper coils with an L-D ratio of 4.4 and external-internal diameter ratio of 4.3. The distance between coils varies from 5 to 15 cm. The magnetic system is placed in a large leather container 1.2 m in diameter and 1.8 m long with 10^{-7} neutrons/m^2 vacuum created by a diffusion pump. Magnetic pressures reach ~200 atm. with an injected particle energy of 30 kev and a maximum ion density 5×10^{15} cm^3. With a gas magnetic pressure ratio of 2×10^{-3}, a density of 10^{13} ions/cm can be reached. Injection of neutral hydrogen atoms, supression of instabilities, and intensification of accumulation are analyzed. (R.V.J.)

17109 (NP-13612) O VYSOKOCHASTOTNYKH KOLEBANIYAKH PLASMY V MAGNITNOM POLE. (On High-frequency Oscillations of Plasma in a Magnetic Field). V. D. Fedorchenko, V. I. Muratov, and B. N. Rutkevich (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 10p.

Plasma at 25 to 50 Mc was produced using electron beams in a strong (3000 gauss) magnetic field at 10^{-6} to 10^{-5} mm Hg. The high frequency field distribution along the system, the role of the second emission, and the relation between the high-frequency and low-frequency (100 kc) oscillations were investigated. (tr-auth)

17110 (NP-13623) INZHEKTSIYA PLASMY V MAGNITNUYU LOVUSHKU SO VSTRECHNYMI POLYAMI. (Plasma Injection into a Magnetic Trap with Opposite Mag-

netic Fields). I. M. Zolototrubov, N. M. Ryzhov, I. P. Skoblik, and V. T. Tolok (Akademiya Nauk Ukr. S.S.R. Fiziko-Tekhnicheskii Institut, Karkov). 1963. 6p.

An intense x radiation appears 840 μsec after plasma injection from a coaxial gun into a trap with opposite fields. The radiation is the result of charged particles bremsstrahlung delay in leaving the trap through the magnetic gap. The radiation energy, equal to 3.8 kev, coincides with the magnitudes of hydrogeneous in the leading cluster of the injected plasma. (R.V.J.)

17111 (NP-13696) OSNOVNYE TEKHNICHESKIE KHARAKTERISTIKI EKSPERIMENTAL'NOI TERMOYADERNOI USTANOVKI "TOKOMAK-III." (Basic Technical Characteristics of the "Tokomak-III" Experimental Installation). M. A. Gashev, G. K. Gustov, E. T. Komar, et al. (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 20p.

The design of Tokomak-III for strong toroidal quasi-stationary discharge in a strong longitudinal magnetic field is described. The toroidal discharge in a vacuum chamber is formed by a vortex electric field. Plasma discharge is confined in a strong longitudinal field. The primary winding in the vortex field, dimagnetization coil, and induction heating coil are distributed in the magnet circuit. The magnetic field, feed, and vacuum systems are described. (R.V.J.)

17112 (NP-13697) VOZBUZHDENIE KOLEBANII ELEKTRONNYM PUCHKOM V PLAZME. (Excitation of Oscillations by an Electron Beam in a Plasma). I. F. Kharchenko, Ya. B. Fainberg, E. A. Kornilov, and N. S. Pedenko (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 10p.

Interaction mechanisms for homogeneous nonmodulated electron beam passage through plasma in a magnetic field were studied using 2 to 5 kev electron beams of 50 ma current with magnetic field intensities to 2000 gauss. At the interaction point the density of plasma reaches 10^{n} e/cm^3 at 5×10^{-3} mm Hg. At certain magnetic field values the initially nonmodulated electron beam becomes unstable with the appearance of intense high- and low-frequency oscillations in both plasma and beam, coherent losses in beam energy, and increased plasma luminescence. The magnitude of magnetic fields with developed instability depends on the residual gas pressure in the interaction region and on the energy of the beam. The instability distribution as functions of magnetic field and oscillation frequencies is given as well as the dispersion characteristics of the plasma-beam system in a magnetic field. (R.V.J.)

17113 (NP-13698) DVIZHENIE PLAZMENNOGO SGUSTKA V MAGNITNOM POLE TOROIDAL'NOGO SOLENOIDA. (Motion of a Plasma Bunch in the Magnetic Field of a Toroidal Solenoid). N. A. Khizhnyak (Akademiya Nauk Ukr. S.S.R. Fiziko-Tekhnicheskii Institut). 1963. 15p.

Interactions of charged particles with a toroidal magnetic field were studied, considering self-consistent polarized fields and closed circuits at the ends of solenoids. Plasma passage through distorted field areas and plasma purification are analyzed and explained. (R.V.J.)

17114 (NP-13705) GAZORAZRYADNAYA IMPUL'SNAYA USTANOVKA DLYA ISPYTANIYA PLAZMENNOI DIAGNOSTICHESKOI APPARATURY. (A Gas-Discharge Pulse Apparatus for Testing Plasma Diagnostic Equipment). V. M. Shatunov and A. V. Chernetskii (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1961. 4p.

The design is given of an installation consisting of a chamber with a longitudinal magnetic field, a vacuum system, and an electric power supply. (R.V.J.)

17115 (NP-13706) ISSLEDOVANIE VZAIMODEISTVIYA PLAZMENNYKH POTOKOV V POPERECHNOM MAGNITNOM POLE. (Investigation of the Interaction of Plasma Flows in a Transverse Magnetic Field). V. G. Zykov, N. G. Sinitsa, I. A. Stepanenko, V. T. Tolok, and K. D. Sinel'nikov (Akademiya Nauk Ukr. S.S.R. Fiziko-Technicheskii Institut). 1963. 14p.

Interactions of polarized plasma fluxes moving in transverse field with frontal collision between injected bunches resulted in a retarding torque and in some cases complete arrest of motion in the initial direction. In contrast to Coulomb interactions, the examined interaction takes place not in the plasma jet but in the frontal region and forms a turbulence with a complex vortex. The interactions take place under any arbitrary plasma parameters and magnetic field intensities. An effective retarding effect was achieved under conditions producing frontal collisions. It is suggested that further studies be carried out with pure hydrogen and deuterium. (R.V.J.)

17116 (NP-13711) OPTIMAL'NYE PARAMETRY MAGNITNOI SISTEMY GVL-2 I NEKOTORYE OSOBENNOSTI NIZKOTEMPERATURNYKH SOLENOIDOV. (Optimum Parameters of the GVL-2 Magnetic System and Some Peculiarities of Low-Temperature Solenoids). F. I. Busol, V. A. Kovalenko, E. I. Skibenko, and V. B. Yuferov (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 12p.

An attempt was made to find optimum magnet coils for strong long-life fields. A system of equations was developed that describes optimum parameters for any solenoid: pulsed or constant low or ordinary temperature. Properties of low-temperature solenoids with various feeds in the GVL-2 trap are discussed. (R.V.J.)

17117 (NP-13743) WILLS PLASMA PHYSICS DEPARTMENT SIXTH SIX MONTHLY PROGRESS REPORT, JULY 1–DECEMBER 31, 1963. C. N. Watson-Munro (Sydney. Univ. School of Physics). Jan. 15, 1964. 25p.

The two plasma sources SUPPER I and SUPPER II continued to operate satisfactorily. Experiments with SUPPER II showed that at high pressures and low magnetic fields it is possible to propagate a $j \times B$ ionizing front with the central electrode negative. Further attempts to collide contra-rotating, $j \times B$ ionizing fronts were also unsuccessful. Temperature measurements were made to determine if appreciable rotational energy was converted into thermal energy in the process of internal crowbar. Doppler shift of line profiles due to the rotational velocity of a He plasma produced by the $j \times B$ process was observed using the 4686 Å line from the He ion and the 5876 Å line from the neutral atom. Additionally, the radial density and temperature distributions in SUPPER I were measured, and microwave observations on decay were made. Waves of frequency 265 kc/sec were successfully launched in SUPPER II by ringing a condenser into the machine. A "prompt" wave was observed, the amplitude of which grows with decreasing axial magnetic field and increasing delay before launching after plasma preparation. (D.C.W.)

17118 (NP-13744) THE PRODUCTION OF HIGHLY EXCITED NEUTRAL ATOMS FOR INJECTION INTO PLASMA DEVICES. Daily Telegraph Theoretical Department TR.2. S. T. Butler and I. D. S. Johnston (Sydney. Univ. School of Physics). Dec. 1963. 13p.

The cross section for the production of highly excited neutral atoms by proton-atom charge exchange was investigated. The implications of the results for plasma production are discussed. (D.C.W.)

17119 (RT/FI(63)-48) THE IMPLOSION PHASE OF A THETA-PINCH. J. E. Allen, G. Gatti, M. Martone, and B. Rumi (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Oct. 1963. 19p.

A study has been made of the implosion phase of a large theta-pinch (CARIDDI), in the presence of an initial magnetic field, but without preionization. High-speed photographic techniques and magnetic probes have been employed and the results are compared with the behavior predicted on the basis of different models of the implosion. (auth)

17120 (RT/FI(63)-49) STUDY OF AN INDUCTIVE SYSTEM FOR THE MEASUREMENT OF LARGE IMPULSE CURRENTS EMPLOYED IN CARIDDI EXPERIMENT. C. Bartoli, A. Boschi, and R. Gratton (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Oct. 1963. 11p.

A study has been made of the measurement of large pulsed currents using an inductive system. Some important limitations inherent in the conventional measuring circuits are demonstrated. Modifications designed to overcome these limitations have been studied theoretically and experimentally. (auth)

17121 (TID-20362) THE USE OF ATOMIC BEAMS AS A PROBE FOR STUDYING LOW-DENSITY PLASMAS. Annual Progress Report. B. Bederson, H. H. Brown, Jr., P. Dittner, E. Gray, and K. Rubin (New York Univ., New York. Coll. of Engineering). [nd]. Contract AT(30-1)-2397. 36p.

The cross section, and the relative velocity dependence thereof, for the scattering of a thermal K beam on H_2, He, Ne, Ar, and Xe was determined. The beam attenuations were also experimentally determined, in excellent agreement with the kinetic theory. The angular resolving power of the apparatus used was investigated. Three cylindrical plasma sources were evaluated, and a small surface ionization detector was built to measure the neutral particle flux from the source. A suitable system for feeding cesium into the plasma cylinder was constructed, using a tantalum-lined cesium flow tube. Calculations were performed on the attenuation of a velocity selected beam by scattering particles and on the fractional ionization of Cs, K, and Rb. Additionally, the fast neutral beam production and detection system was completed. Fast neutral currents were successfully observed, and some diagnostic tests were made on the fast neutral beam. Additions and modifications to the atomic beam apparatus are summarized. (D.C.W.)

17122 (NASA-TT-F-175) FUNDAMENTALS OF COSMIC ELECTRODYNAMICS. S. B. Pikel'ner. Translation of "Osnovy kosmicheskoy elektrodinamiki" (a publication of the State Publishing House for Physico-Mathematical Literature, Moscow, 1961). 268p.

The basic notions of cosmic electrodynamics are presented systematically in a manner accessible to a large audience, and their relation to astrophysics and geophysics is shown. The subject matter presented includes the following chapters: I. Plasma With No Magnetic Field; II. Plasma in a Magnetic Field; III. The Interaction of a Magnetic Field and a Moving Conducting Medium; IV. Plasma Waves; V. Stability; VI. Increase in Field Strength Resulting From Motion of a Medium; and VII. Applications to Astrophysics. (auth)

17123 COMMENT ON "PROPULSION APPLICATION OF THE MODIFIED PENNING ARC PLASMA EJECTOR." E. A. Pinsley, E. C. Lary, and R. G. Meyerand, Jr. (United Aircraft Corp., East Hartford, Conn.). AIAA (Am. Inst. Aeron. Astronaut.) J., 2: 401-3(Feb. 1964).

Critical comments on a previous paper (NSA 17: 24077) on the propulsion applications of a Penning arc plasma ejector are presented. (R.E.U.)

17124 THE THEORY OF MOVING STRIATIONS IN A D-C DISCHARGE PLASMA. II. HIGH CURRENT APPROXIMATION. L. Pekárek and V. Krejcí (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czech. J. Phys., 13: 881-94(1963).

The integrodifferential equation of striations is simplified for the case when the Debye length l_D is vanishing small in comparison with the wavelength of the striations. The (still non-zero) space charge field then influences the motion of the charge carriers in such a way that it takes on the character of ambipolar diffusion in the axial direction. The influence of the space charge field on the ionization rate through the changes in the electron temperature is also taken into account. The oscillatory behavior of the transient process excited by a pulse disturbance, as well as growth of the amplitude of the transient wave, is described in the analysis. The transient solution is in agreement with experiment. This shows that processes found to be decisive for the very nature of moving striations and for their amplification determine, with sufficient accuracy, other finer properties of striations. The choice of optimum wavelength, in the conditions studied, is fulfilled by the ambipolar diffusion in the axial direction, which damps the short-wavelength striations, and by the final value of the relaxation length of the electron temperature, which limits the long-distance effect of the electric space charge field on the ionization rate. (auth)

17125 THE HAMILTONIAN OF THE GUIDING CENTER IN THE ELECTROMAGNETIC FIELD. J. Lacina (Inst. of Vacuum Electronics, Czechoslovak Academy of Sciences, Prague). Czech. J. Phys., 14: 5-13(1964).

The Hamiltonian of the guiding center in an adiabatically variable electromagnetic field (for the relative variations of the field $1/H \cdot dH/dt \ll \omega_c$, $1/E \cdot dE/dt \ll \omega_c$) is derived in the present paper. The solution of the corresponding canonical equations is given for an axially symmetric stationary electromagnetic field. (auth)

17126 INTERNATIONAL SYMPOSIUM ON PLASMA PHENOMENA AND MEASUREMENT, IEEE-PTGNS TENTH ANNIVERSARY MEETING, SAN DIEGO, CALIFORNIA, OCTOBER 29–NOVEMBER 1, 1963. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 1-388 (Jan. 1964). New York, Institute of Electrical and Electronics Engineers, Inc., 1964. $10.00.

Separate abstracts were prepared for 28 of the 49 papers presented; 19 were previously abstracted for NSA. The remaining two papers are on stagnation-point radiative heat transfer measurements at supersatellite velocities and the description of helium–plasma rate processes (an abstract only). The contents are divided into plasma measurements, electromagnetic interactions with plasma, plasma generation, plasma diagnostics, radiation effects on tin and silicon, and nuclear instrumentation. (R.E.U.)

For abstracts of individual papers see: 16283, 16284, 16285, 16286, 16314, 16315, 16532, 16559, 17127, 17128, 17129, 17130, 17131, 17132, 17133, 17134, 17135, 17136, 17137, 17138, 17139, 17140, 17141, 17142, 17143, 17144, 17145, and 17265.

17127 CESIUM PLASMA MEASUREMENTS. G. S. Kino (Stanford Univ., Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 1(Jan. 1964).

The modes of production of cesium plasma and the advantages of each for the particular application are discussed. (R.E.U.)

17128 PLASMA INJECTION AND TRAPPING MEASUREMENTS. F. Robert Scott (General Atomic Div., General Dynamics Corp., San Diego, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 2(Jan. 1964).

Experiments in plasma injection and trapping and techniques used to examine the plasma-field interaction are discussed. (R.E.U.)

17129 THE PROPAGATION OF AN ELECTROMAGNETIC WAVE THROUGH A DIFFUSING PLASMA. William H. Schoendorf (Conductron Corp., Ann Arbor, Mich.) and Floyd V. Schultz. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 23-33(Jan. 1964).

The propagation of an electromagnetic wave through a fully ionized diffusing plasma slab is investigated. The slab is considered to be diffusing in an ambipolar fashion, with the electron–ion collision frequency proportional to the spatial and time varying ion density. The propagation characteristics of the wave are shown to be dependent on the relation between n_p and n_c, the densities where the signal frequency is equal to the plasma frequency and collision frequency, respectively. This relation is temperature dependent. The reflection and transmission coefficients of the plasma are calculated as a function of signal frequency, and their behavior as the slab diffuses is investigated. (auth)

17130 WAVES IN A CIRCULAR PLASMA COLUMN WITH GENERAL IMPEDANCE BOUNDARY CONDITIONS. Paul O. Berrett and Curtis C. Johnson (Univ. of Utah, Salt Lake City). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 34-40(Jan. 1964).

Electromagnetic waves in a plasma column subjected to generalized impedance boundary conditions are studied. A general dispersion equation is obtained, which is solved numerically on a high speed digital computer, the boundary impedances being either read in on cards as fixed impedances or calculated from a subroutine written for a specific problem. The effects of resistive and reactive components in the boundary impedances are shown. True zeros of the determinantal equation are found to occur for real β only when pure reactance is presented to the plasma surface. (auth)

17131 BASIC MEASUREMENTS IN A RAIL TYPE PLASMA GUN. Emile Le Grives, Thiebaut Moulin, Emilien Robert (Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux, France). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 47-57(Jan. 1964).

The rail-type plasma-gun is a well suited laboratory set-up for the experimental determination of the physical properties of short lived plasmas. The ONERA plasma-gun is the most conventional rail type gun, with two cylindrical electrodes; an electrical discharge between two auxiliary electrodes generates the plasma whenever a puff of argon is injected into the plasma gun. Measurements on the set-up are devised to give the following data: mass flow rate through the injection nozzle or amount of argon corresponding to each puff; current and voltage during a discharge; self induction of the rails; shape and displacement of the plasma column (magnetic coil probe and photocell recordings). Though not necessarily an efficient space propulsion device, the parallel rail plasma-gun allows the development and improvement of many experimental techniques, which can be used for the study of more efficient electric thrustors. (auth)

17132 ANALYSIS OF ARC-HEATING PHENOMENA IN A TUBE. J. G. Skifstad and S. N. B. Murthy (Purdue Univ., Lafayette, Ind.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 92-103(Jan. 1964).

An analysis of the flow and energy transport processes in an arc-heating device in which an electric arc and a gas flow pass concurrently through a cylindrical tube is presented. The particular region of interest in the tube is the inlet length over which the hot gas is always separated from the tube wall by a layer of unheated gas. The analysis demonstrates the manner in which the flow parameters in the tube may be computed by the matching of the unheated flow and the heated flow at the thermal boundary for given end boundary conditions. Experimental data obtained with an arc heater are presented in support of the analytical model. (auth)

17133 AXIAL FLOW THROUGH THE WALL-CONSTRICTED DIRECT-CURRENT ARC–COMPARISON OF THEORY AND EXPERIMENT. James R. Jedlicka and Howard A. Stine (Ames Research Center, Moffett Field, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 104-8(Jan. 1964).

The basis of a simple theoretical analysis of the behavior of a wall-constricted plasma generator is considered. Experimental results are presented for a plasma generator designed from gas transport properties and theory. In general, the agreement between theory and measured performance of the plasma generator indicates that the underlying physical principles are reasonably well understood. (auth)

17134 THEORY AND EXPERIMENT WITH A GAS STABILIZED CONSTRICTED ARC. S. Bennett and J. F. Connors (AVCO Corp., Wilmington, Mass.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 109-18(Jan. 1964).

Measurements of voltage gradient and static pressure distribution in the constrictor of a gas-stabilized constricted arc discharge are reported. These and previously obtained data yielding the column diameter are used to compare the behavior of this discharge with laminar column theories. Significant disagreement is found, and it is concluded that the discharge represents an inlet flow region. A qualitative model is presented of the physical processes occurring in this inlet region. The implications for arc heater efficiency of this model and of the data are discussed. (auth)

17135 CONTINUUM RADIATION FROM ARC HEATED PLASMAS. J. C. Morris and G. R. Bach (AVCO Corp., Wilmington, Mass.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 119-24(Jan. 1964).

Measurements of the spectral continuum of arc-heated nitrogen plasma were made using high-dispersion spectroscopic equipment. These measurements cover a wavelength range of 2700 to 44,000 Å, and a temperature range of 9500 to 12,000°K. The measurements were compared with a number of theoretical studies of both the spectral and total emissivity. An estimate of the contribution to the continuum of the negative nitrogen ion was included, and a new value of the effective nuclear charge for Kramers free-free radiation was measured. (auth)

17136 GASDYNAMIC DIAGNOSIS OF HIGH-SPEED FLOWS EXPANDED FROM PLASMA STATES. J. Leith Potter, George D. Arney, Jr., Max Kinslow, and William H. Carden (ARO, Inc., Arnold Air Force Station, Tenn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 145-57(Jan. 1964).

Methods are described of determining quantities that define the flow in low-density, hypersonic wind tunnels, which use plasma generators to heat the working fluid. Although the fluid was heated to a plasma state initially, with a typical bulk temperature of 12,000°R, the measurements reported were for the purpose of calibrating the flow in the aerodynamic nozzle of a wind tunnel where it was desired that the fluid be recombined prior to or during the expansion to high speeds. All of the methods considered may be classed as gasdynamic or aerodynamic as opposed to, say, spectroscopic methods. Measurements of total enthalpy, total and static pressure, and local mass flux are discussed, with descriptions of the equipment and typical results included. (auth)

17137 SOME PROPERTIES OF PLASMAS FORMED BY REFLECTION OF ELECTROMAGNETICALLY DRIVEN SHOCKS. G. Rausa (Martin Co., Baltimore). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 170-5(Jan. 1964).

The objective of the experiments was to determine the suitability of plasmas generated by reflected shock techniques in a conically driven shock tube for the study of several problem areas in re-entry physics. During the course of the investigation, one of the most difficult problems encountered was the production of reproducibility. This was never satisfactorily achieved with the configuration. It was necessary to conclude that the plasma produced was of little value for radiation studies because of the high degree of impurity. This level of impurity makes any afterflow studies in this type of configuration of questionable value also. Although the tube provides a source of ionized gas for microwave probing, the plasma so generated can hardly be considered as similar to that encountered under re-entry conditions. The microwave probing did indicate however that estimates of plasma properties could be in error if such are made on the basis of measurement of only a single parameter, i.e., transmission or reflection. (auth)

17138 A COLLIMATED TOTAL RADIATION PROBE FOR ARCJET MEASUREMENTS. Jerry Grey, Martin P. Sherman, and Paul F. Jacobs (Princeton Univ., N. J.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 176-86(Jan. 1964).

The total energy radiation of an argon arcjet was measured by a simple collimated thermopile. Radiation from the luminous jet was found to vary as $T^{7.2}$ when the peak (centerline) temperature at the arcjet exit plane was 12,600°K. Total radiated energy from the arcjet, including the downstream-directed component from the cathode face, was found to agree quite well with theoretical estimates given in the present paper. The use of a purified helium atmosphere and lithium fluoride optical components permitted achievement of transmissivity down to 1060 angstroms on all measurements. (auth)

17139 SIMULATION OF A THIN PLASMA SHEATH BY A PLANE OF WIRES. K. E. Golden and T. M. Smith (Aerospace Corp., Los Angeles). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 225-30(Jan. 1964).

A method of simulating a thin plasma sheath, of the type encountered in some aero-space applications, by using a single plane of equally spaced wires is described. It is shown that the surface impedance of such a periodic structure can be made equal to that of a thin plasma sheath. In this treatment, the respective surface impedances are related through three dimensionless parameters. A simple technique for obtaining high losses is also discussed, whereby collision frequencies in the neighborhood of the operating frequency are realizable. Experimental data, including both the lossy and lossless cases, is compared with the theoretical model in the X-band region. (auth)

17140 SOME CHARACTERISTICS OF A TWO-STAGE REPETITIVELY FIRED COAXIAL GUN. Per Gloersen (General Electric Co., Valley Forge, Penna.), Bernard Gorowitz, and Joseph H. Rowe. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 249-65(Jan. 1964).

The performance of a two-stage, repetitively pulsed plasma engine intended for space propulsion is described. The luminous species present in the exhaust and their velocities were investigated using accelerators. (R.E.U.)

17141 IONIZATION AFTERGLOW MEASUREMENTS ON NITROGEN. V. A. J. van Lint (General Atomic Div., General Dynamics Corp., San Diego, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 266-71(Jan. 1964).

The ionization afterglow experiments, which are described, utilize a beam of high-energy electrons (20 to 30 Mev) to produce a uniform and known concentration of ionization in a gas sample. Measurements of the electron density and collision frequency are then performed by observing the interaction of the free electrons with a probing microwave field. Studies of nitrogen have indicated that the apparent rate of electron thermalization at slightly epithermal energies is consistent with elastic scattering alone. The collision frequency at thermal energies is in good agreement with that determined from drift experiments. Electron-ion recombination is anomalous because the apparent recombination coefficient is a function of the initial ionization intensity. This observation may be ascribed to the influence of metastables. (auth)

17142 CHARACTERISTICS OF A MERCURY ARC DISCHARGE IN A MAGNETIC FIELD. V. Gilson and C. C. Johnson (Univ. of Utah, Salt Lake City). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 272-6 (Jan. 1964).

Langmuir double probes and microwave resonant cavities were used to determine the axial magnetic field effects on the electron temperature, plasma density, and a low frequency natural oscillation in a mercury arc at low pressure. It was found that the magnetic field causes the electron temperature to greatly increase and become dependent on the amount of discharge current. The plasma density develops pronounced axial variations in the presence of the magnetic field. The natural oscillation frequency was found to be independent of the magnetic field or discharge current. (auth)

17143 MICROWAVE DIAGNOSTICS OF PLASMAS. R. W. Grow, C. C. Johnson, and A. S. Jones (Univ. of Utah, Salt Lake City). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 277-83(Jan. 1964).

The theory of wave propagation in plasma media where temperature and collision effects are important is formulated by combining the wave equation and Boltzmann's equation for average electron velocity. Usually it is assumed that the electron collision frequency is independent of velocity, but most gases are characterized by a velocity-dependent collision cross section and the electron collision frequency is velocity dependent. It was shown that when the velocity dependence of the collision frequency is neglected,

electron density predictions are in considerable error. A wave theory that accounts for the velocity-dependent electron collision frequency was worked out and applied to the measurement of electron density, temperature, and collision frequency in a rocket exhaust plasma. (auth)

17144 PLASMA DIAGNOSTIC AND SIMULATION THROUGH CORRELATION TECHNIQUES. H. Hodara, C. M. Knop, and T. F. Curran (Hallicrafters Co., Chicago). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 374-80(Jan. 1964).

A diagnostic technique based entirely on the measurement of the transfer function for a communication system is described for investigating the effects of the plasma. The technique also provides a method to simulate electronically, plasma effects on communication signals by constructing a network having the same transfer function as the communication system. (R.E.U.)

17145 GASDYNAMIC INSTRUMENTATION OF HIGH ENTHALPY FLOWS. Stanley Byron and Richard M. Spongberg (Philco Corp., Newport Beach, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 381-7(Jan. 1964).

Techniques for making measurements of gas properties in supersonic plasmas generated by continuous thermal arc heaters and crossed field accelerators are described. Measurements of static pressure, total pressure, flow velocity, local mass flow, and local total enthalpy are described. The use of these measurements together with the relations between the gasdynamic parameters such as temperature, pressure, density, specific heat, sound speed, Mach number, and degree of dissociation and ionization are discussed. When the gas is out of equilibrium, as it is in crossed field accelerator plumes produced to date and in many thermal arc jets, the number of independent measurements required to determine the gas properties unambiguously is three plus one for each non-equilibrium energy reservoir. Results obtained in argon plumes using velocity, static pressure, total pressure, local mass flow, and local total enthalpy probes are presented. Gas properties determined from these measurements are given, and the degree of reliability of the measurements is ascertained by cross-checks wherever possible. (auth)

17146 APPLICATION OF OPERATIONAL METHODS TO THE ANALYSIS OF UNIFORM PLASMAS. Saul Dilven (McDonnell Aircraft Corp., St. Louis). J. Math. Phys. (N. Y.), 5: 557-60(Apr. 1964).

Various aspects of plasma theory are derived by the application of operational methods to the equation of electron motion. Discussed herein are the complex tensor dielectric constant, the tensor permittivity and conductivity, plasma transient behavior, and plasma oscillations. (auth)

17147 MICROWAVE RADIATION FROM A PLASMA IN A MAGNETIC FIELD. [PART] I. Kenji Mitani (Kyoto Univ.), Hiroshi Kubo, and Shigetoshi Tanaka. J. Phys. Soc. Japan, 19: 211-20(Feb. 1964).

The microwave radiations from a d-c discharge plasma in a magnetic field were studied. The experimental results showed that the resonant radiations of the extraordinary wave, propagating perpendicular to a magnetic field, were observed not only at $\omega = (\omega_p^2 + \omega_b^2)^{1/2}$, but also near the cyclotron harmonics. On the other hand, it was shown that the dispersion relation for the plasma type oscillations derived by Bernstein had a harmonic structure. This dispersion curve is divided into many branches, each of which approached asymptotically to the curves given by $\omega^2 = \omega_p^2 + \omega_b^2$ and by $\omega = n\omega_b$ (n being an integer). The resonant radiation detected was interpreted as the plasma type radiation. The gaps in the radiation spectrum at the cyclotron harmonics were not measured in our discharge plasmas. The number of the successive harmonics in a radiation increased with decreasing gas pressure, independently of a kind of gas used. (auth)

17148 MICROWAVE RADIATION FROM A PLASMA IN A MAGNETIC FIELD. [PART] II. Hiroshi Kubo (Kyoto Univ.), Kenji Mitani, Shigetoshi Tanaka, and Yasushi Terumichi. J. Phys. Soc. Japan, 19: 221-6(Feb. 1964).

The microwave radiation from a d-c discharge plasma in a magnetic field was studied. The experimental results showed that the resonant radiations of the ordinary wave, propagating perpendicular to a magnetic field, were observed near the electron cyclotron harmonics. The number of the successive harmonics increased with decreasing the gas pressure, independently of the kind of gas used. The characteristics of these radiations were very similar to those of the extraordinary wave. Such cyclotron harmonics were discussed by the dispersion relation. (auth)

17149 THE INTERACTION OF A PLASMA STREAM WITH A THREE-DIMENSIONAL DIPOLE. Nobuki Kawashima (Tokyo Univ.). J. Phys. Soc. Japan, 19: 227-34(Feb. 1964).

The interaction of a plasma stream with a three-dimensional dipole was experimentally investigated. The time exposure photographs and magnetic probe measurement show the formation of a magnetic cavity, as theoretically predicted. (auth)

17150 PROPAGATION OF PLASMA WAVES IN A "SPOKE-WHEEL" MAGNETIC FIELD. Richard L. Liboff (Nuclear Research Associates, Long Island City, N. Y.). J. Res. Natl. Bur. Std., 68D: 325-31(Mar. 1964).

A study of the cold plasma cylindrical waves that may propagate in a specific type of two-dimensional magnetic field is initiated. The plasma is assumed to be of uniform density and collisionless, and a "spoke-wheel" magnetic field is considered, which is both anisotropic and inhomogeneous (varying as the inverse radius). Perturbation series solutions are obtained for the first Fourier component of the electric field for the four extreme cases: large and small magnetic field; large and small plasma densities. (auth)

17151 PLASMA ACCELERATION BY ELECTROMAGNETIC AND MAGNETOSTATIC FIELD GRADIENTS. Térenzio Consoli and R. B. Hall (Centre d'Etudes Nucléaires, Saclay, France). Nucl. Fusion, 3: 237-47(Dec. 1963). (In French)

The movement of charged particles in electromagnetic and magnetostatic field gradients is examined. It is shown that when the orientation and amplitude of such gradients are suitably arranged, the mean force in relation to time acting on these particles remains constant in direction. The mean force and, more generally, the validity of the theory of mean value in relation to time are discussed. The results are applied to the case of a low-density plasma, and a brief description is given of four possible applications of a device based upon such forces: as injector, plasma propellant, vacuum pump, and direct converter of thermal energy into uhf electromagnetic energy. Orders of magnitude are stated. The limits of validity of the theory based on mean value are determined, and a comparison is made with an exact theory. The curves obtained are described and classified by analog computer. (auth)

17152 RATE OF EQUALIZATION OF "LONGITUDINAL" AND "TRANSVERSE" PLASMA TEMPERATURES.

Yu. M. Aliev and V. P. Silin (Lebedev Inst. of Physics, Moscow). Nucl. Fusion, 3: 248-50(Dec. 1963). (In Russian)

Equalizing times of "longitudinal" and "transverse" electron and ion temperatures of a fully ionized plasma in a uniform magnetic field are considered. A kinetic equation is used with a collision integral that takes into consideration the strong interaction between particles at small distances and the fact that without interaction plasma electrons and ions move along helixes. In this sense such an equation corresponds to the kinetic Boltzmann equation since when calculating relaxation times, there occurs automatically a cutoff for logarithmically diverging integrals at small distances. Consideration of the fact that the trajectories of the noninteracting particles are helixes makes it possible to discuss a case in which the Larmor radii of the particles are smaller than the Debye radius. It was shown that under these conditions the principal role of the maximum impact parameter in a Coulomb logarithm for making the ion temperature isotropic is played by the Larmor radius of the ions, and for making the electron temperature isotropic, by the Larmor radius of the electrons. For equalization of the longitudinal and transverse ion temperatures only collisions of ions among one another are important. Electron temperature becomes isotropic through both inter-electron collisions and collisions between electrons and ions. The relaxation times deduced actually determine the pulse relaxation of plasma particles along the magnetic field. Comparison of these expressions with the characteristic times defining the coefficients, obtained earlier, for transfer in a plasma across a magnetic field makes it possible to say that under conditions such that the field affects the collision process, relaxation times for the pulse along and transverse to the magnetic field differ. (auth)

17153 ČERENKOV ABSORPTION OF "WHISTLES" IN AN INHOMOGENEOUS PLASMA CYLINDER. V. V. Dolgopolov, A. I. Ermakov, N. I. Nazarov, K. N. Stepanov, and V. T. Tolok (Khar'kov Inst. of Physics and Tech.). Nucl. Fusion, 3: 251-4(Dec. 1963). (In Russian)

Cherenkov absorption of electromagnetic waves by plasma electrons that have a frequency considerably smaller than the gyro frequency of electrons and considerably larger than the gyro frequency of ions, the so-called "whistling atmospherics" that propagate along the inhomogeneous plasma cylinder, is described. An expression was deduced for the energy absorbed by a unit length of the plasma cylinder in unit time, and a coefficient was found for the damping of free oscillations propagating along the plasma cylinder. If the phase velocity of the wave is of the order of the thermal velocity of the electrons and the wavelength is of the order of the plasma radius, the energy gained on the average by one plasma electron equals $dW/dt \approx (H_z^2/H_0^2)\,\omega T_e$ (H_z is the amplitude of the magnetic field of the wave; ω is its frequency; H_0 is the steady magnetic field strength; T_e is the electron temperature). The limits of applicability of the linear theory are discussed. For fields H_z larger than some critical value $H_c \approx H_0(\omega\tau)^{1/2}$, where τ is the frequency of collisions between electrons and ions, a plateau forms for the background distribution function. Under optimal conditions, when distortion of the distribution function is not large, $dW/dt \approx T_e/\tau$. Since $W \approx T_e$, electron temperature increases in this case according to the law $T_e \approx T_0[1 + at/\tau]^{1/2}$, where T_0 is the initial electron temperature; $a \approx 1$. Since the field of whistles penetrates well into the plasma, their Cherenkov absorption can be used for the heating of the electron component of a plasma with large density ($n_0 \approx 10^{14}$ to 10^{15} cm^{-3}) and with a sufficiently large initial temperature ($T_0 \gtrsim 100$ ev). (auth)

17154 INVESTIGATION OF RESONANCE EXCITATION AND ČERENKOV DAMPING OF HIGH-FREQUENCY PLASMA OSCILLATIONS. N. I. Nazarov, A. I. Ermakov, V. V. Dolgopolov, L. N. Stepanov, and V. T. Tolok (Khar'kov Inst. of Physics and Tech.). Nucl. Fusion, 3: 255-8(Dec. 1963). (In Russian)

Resonance excitation and the damping mechanism of high-frequency oscillations of a plasma cylinder in an external magnetic field were investigated. Wave excitation was accomplished with a system of external coils creating a spatially periodic electromagnetic field with a period $\lambda_0 =$ 15 cm. The operating frequency (f = 10 MHz) was considerably smaller than the electron cyclotron frequency ($\omega \approx \omega_{He}/200$) and greater than the ion cyclotron frequency. It was shown that the oscillations penetrate well into the plasma. The wavelength measured along the direction of the magnetic field λ_z coincides with the period of the exciting coil λ_0 and corresponds to the length of the wave that is defined from the dispersion ratio for these oscillations. The direction of the rotation of the wave coincides with the direction of the rotation of the electron in a magnetic field. The measured damping length of the wave was l = 40 cm. Plasma density was $n_0 \approx 5 \times 10^{13}$ ions/cm^3, electron temperature was $T_e \approx 50$ ev, and the wavelength in the damping region was $\lambda_z = 10$ cm. Wave damping length due to collisions was $l_{st} \approx \lambda_z\,\omega_{He}/2\pi\nu$ (ν is the frequency of collisions between electrons and ions) of the order of 10^4 cm, which exceeds the value measured by more than a hundred times. Damping length due to the collisionless Cherenkov mechanism is $l_L \approx (\lambda_z/2\pi)^2\,(m/T_e)^{1/2}\,\omega_{He} = 60$ cm, which compares well with the value measured. On these grounds the conclusion is drawn that the observed damping is caused by the collisionless Cherenkov mechanism. (auth)

17155 CYCLOTRON PLASMA INSTABILITY: II. PLASMA IN A NON-MAXWELLIAN DISTRIBUTION OF IONS. Yu. N. Dnestrovskii (Moscow State Univ.). Nucl. Fusion, 3: 259-64(Dec. 1963). (In Russian)

Cyclotron instability is studied in a homogeneous plasma with an anisotropic non-Maxwellian distribution of ions and with Maxwellian electrons. It is shown that plasma can be unstable at any ratio between mean transverse and mean longitudinal ion energy, if the ion distribution function for the transverse velocities is a nonmonotonous function. The "beam" character of the function is in this case the physical cause for appearance of this type of instability. The "quasitransverse" waves are the most unstable waves, propagating almost perpendicularly to the external field. Plasma stability improves with the increase of electron temperature. If the mean transverse ion energy is much larger than the longitudinal energy, the effect of nonmonotony of the function becomes unessential, and previous results remain valid for cyclotron instability. (auth)

17156 BREAKDOWN OF HELIUM IN A STELLARATOR BY LARGE-AMPLITUDE MAGNETIC PUMPING. John M. Dawson, Carl R. Oberman, and Russell M. Kulsrud (Princeton Univ., N. J.). Nucl. Fusion, 3: 265-70(Dec. 1963).

A Monte Carlo method was used to investigate the early stages of ionization of neutral helium, as produced by large-amplitude magnetic pumping in a stellarator. The competing processes considered were ionization, excitation, elastic scattering, and electron diffusion in and out of the pumping region. The e-folding time τ_e for the electron density was computed for various values of the modulation M (ratio of pumping field to static confining field), mirror

ratio R (ratio of the static field in the tube to its value in the pumping region), and neutral density n_0. Other pertinent parameters were the pumping frequency ν, length of pumping region l, and the remaining machine length L. These were for the most part confined to values concordant with those of the B-2 stellarator (ν = 200 kHz, l = 50 cm, L = 500 cm). It was found for values of M > 0.7, that τ_e varied roughly as $(1 - M)^{-1}$. The dependence on R and n_0 was slight. In addition it was found that when the average number of inelastic collisions is greater (less) than one during a pumping cycle, the electron temperature is less (greater) than the ionization energy. A phenomenological theory based on the results of these calculations agrees with the observed modulation required for breakdown in B-2. (auth)

17157 THEORY OF INTERACTION BETWEEN PARTICLES AND WAVES WITH A NON-EQUILIBRIUM PLASMA. I. A. Akhiezer and Yu. L. Bolotin (Khar'kov Inst. of Physics and Tech.). Nucl. Fusion, 3: 271-5(Dec. 1963). (In Russian)

It was shown previously that in a nonequilibrium plasma that is near an unstable state, abnormally large, so-called "critical" fluctuations are possible. As is known, through fluctuation correlation operators one defines such plasma characteristics as the stopping power (energy losses of charged particles passing through a plasma) and also scattering coefficients of different types of oscillations and their transformation into oscillations of other types. Owing to the presence of critical fluctuations, these plasma characteristics can be abnormally large if the plasma state approaches an unstable state. Interactions between particles and a plasma consisting of cold ions and hot electrons that move with respect to the ions are discussed. The particle energy losses for the excitation of acoustic oscillations are defined. If the projection of particle velocity is in the direction of electron motion, sound velocity and the directed electron velocity are near each other, and particle energy losses are abnormally large and can exceed energy losses due to two-body collisions. The question of interaction between a particle and short-wave (Langmuir ion) oscillations is considered. Interactions in a plasma through which a compensated beam of charged particles passes are discussed. Expressions were deduced for the cross sections of a particle for scattering and for energy losses to the excitation of Langmuir oscillations. Energy losses of the particle are specially large if its velocity is near beam velocity in both value and direction. Transformation of transverse waves into longitudinal waves and scattering of longitudinal plasma waves with a directed electron motion are considered. The transformation and scattering coefficients that characterize increase of energy density of the secondary wave per unit time which are abnormally large are discussed. (auth)

17158 FLUTE PERTURBATIONS OF A PLASMA IN A HELICAL MAGNETIC FIELD. L. V. Mikhailovskaya and A. B. Mikhailovskii (Kurchatov Inst. of Atomic Energy, Moscow). Nucl. Fusion, 3: 276(Dec. 1963). (In Russian)

Flute perturbations of a plasma that is in a helical, cylindrically symmetric magnetic field were studied. In a geometrical-optics approximation an equation was obtained that relates the frequency and the wave vector of the flute perturbations of the plasma for an arbitrary relation of the gas pressure and the magnetic pressure, and for an arbitrary ratio q/λ of the Larmor radius of the ions to the wavelength. This equation is used to obtain stability criteria and increments (decrements) of flute-type oscillations under conditions when the shear in the lines of force is insignificant. The stability condition obtained thus in an approximation of zero Larmor radius of the ions coincides with the corresponding results that follow from the hydrodynamics of Chew, Goldberger, and Low. For small values of β and a finite ratio q/λ, a criterion was obtained for the stabilization of perturbations with the finite Larmor radius of the ions. Consideration of interaction between resonance particles and the wave in a number of cases leads to the buildup of flute perturbations. It is shown that such a type of buildup—residual instability—in the case of a helical magnetic field differs essentially from the residual instability for a model with a force of gravity, which is due to differences in the direction of the drift of the resonance particles in the two cases. The effect of curvature of lines of force on flute perturbations of the type of transverse drift waves was discussed. It is shown that for not too large a radius of curvature of the line of force $R < a/\beta$ (a is the characteristic dimension for the change of plasma pressure), the instability predicted in the work of Krall and Rosenbluth for such a type of oscillations in a field with $R \to \infty$, is stabilized. (auth)

17159 EXPERIMENT ON THE USE OF AN AUXILIARY DISCHARGE TO INVESTIGATE PLASMA PROPERTIES IN A THETA PINCH WITH A TRAPPED REVERSE MAGNETIC FIELD. I. F. Kvartskhava, K. N. Kervalidze, G. G. Zukakishvili, and Yu. S. Gvaladze (Inst. of Physics and Tech., Academy of Sciences, Sukhumi, Georgian SSR). Nucl. Fusion, 3: 285-92(Dec. 1963). (In Russian)

The results of experiments carried out with a z-pinch of plane configuration and a theta pinch of round cross section are discussed. It is shown that under certain discharge conditions the behavior of the plasma in these pinches is characterized by a far-reaching analogy. On this basis an attempt was made to use the results of investigation of the plane z-pinch for a better understanding of the processes under the complicated conditions of discharge in a theta pinch with a trapped reverse field. A possible mechanism of plasma rotation that was observed in the theta pinch under these discharge conditions is considered. (auth)

17160 Z-PINCH DYNAMICS FOR SINUSOIDALLY TIME-DEPENDENT DISCHARGE CURRENTS. F. L. Curzon and R. Howard (Univ. of British Columbia, Vancouver). Nucl. Fusion, 3: 293(Dec. 1963).

The comparison of measured pinch times to the results obtained by solving the snow-plow equation for sinusoidally time-dependent discharge currents is discussed. A plot of pinch time against the square-root of gas density divided by discharge current is given for typical Z-pinches in argon and nitrogen. (R.E.U.)

17161 ENERGY PRINCIPLE FOR ELECTROSTATIC STABILITY OF A PLASMA. E. Minardi (FOM-Instituut voor Plasma-Fysica, Rijnhuizen, Jutphaas, Netherlands). Nuovo Cimento (10), 31: 674-8(Feb. 1, 1964).

A one-dimensional collisionless plasma contained in a box with an external electric potential is considered. It is shown that the equation, which describes the equilibrium configuration of the electric field in the plasma, can be derived by means of a variational principle concerning the electrostatic energy. It is also shown that a relation exists between the stability or instability of the equilibrium of the plasma in the box and the minimum or maximum value of the electrostatic energy. (C.E.S.)

17162 MICROSTABILITY CONDITIONS FOR A PLASMA IN A BOX. E. Minardi (FOM-Instituut voor Plasma-Fysica, Rijnhuizen, Jutphaas, Netherlands). Nuovo Cimento (10), 31: 679-81(Feb. 1, 1964).

The conditions for electrostatic stability of a plasma in

a box with an externally applied electric potential are discussed for particular cases in which the stability criterion assumes a simple and physically intuitive form. (C.E.S.)

17163 SUPERPOSITION OF DRESSED TEST PARTICLES. Norman Rostoker (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids, 7: 479-90(Apr. 1964).

Kinetic theory for a spatially homogeneous plasma with Coulomb interaction is considered within the framework of the adiabatic approximation or secular perturbation theory. Time dependent solutions are obtained for the pair correlation function, multiple time distribution functions, etc. Autocorrelation functions and spectral densities for fluctuating quantities are defined and obtained for a stable or unstable plasma. The results show that the plasma behaves as though it consisted of statistically independent quasi-particles. The relation between test-particle problems and the more general kinetic theory is clarified. Physical interpretation of each term in the Fokker-Planck equation is provided in terms of spontaneous emission, induced emission, and absorption. (auth)

17164 TEST PARTICLE METHOD IN KINETIC THEORY OF A PLASMA. Norman Rostoker (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids, 7: 491-8(Apr. 1964).

A test particle of coordinates X = (x,v) is surrounded by a shield cloud of field particles of coordinates X′ characterized by a conditional probability function P(X|X′t). A relationship was found between this function, the one-particle function f(X,t) and the two-particle correlation function G(X,X′; t). The first two terms indicate that each of the two particles involved is a test particle as well as part of the shield cloud of the other particle. The last term corresponds to the two particles shielding a third particle. This relation was established without solving explicitly for anything and has none of the usual restrictions such as spatial homogeneity, adiabatic time behavior, etc., usually necessary for obtaining explicit solutions. It is useful because the problem of kinetic theory is reduced to determining P, which involves only the Vlasov equation. In addition, superposition principles for fluctuations, etc., are apparent at the outset. (auth)

17165 SELF-CONSISTENT METHOD FOR DETERMINING THE BOUNDARY SHAPE BETWEEN A PLASMA AND A MAGNETIC FIELD. John C. Baker, David B. Beard, and John C. Young (Goddard Space Flight Center, Greenbelt, Md.). Phys. Fluids, 7: 504-10(Apr. 1964).

A calculational method of determining the boundary surface between a plasma and a magnetic field is described. The method consists of neglecting the curvature of the surface and approximating the magnetic field adjacent to the boundary by a sum of the field due to the local surface current and the plasma-independent magnetic field source. This field is used in the boundary equations to compute the boundary surface. The resulting surface is then used to compute the magnetic field due to the curvature of the surface and the computation of the boundary surface is repeated. Reiteration of the calculational steps is continued until a self-consistent solution is obtained in which the magnetic field resulting from the curvature of the previous surface is used to obtain a surface whose shape does not differ from the previous surface by more than the imprecision of the calculation of the magnetic field. The method is illustrated by application to three simple problems of (1) a line dipole immersed in a plasma exerting a constant pressure on the boundary, (2) a point dipole immersed in plasma exerting constant pressure, and (3) a line dipole in a plasma stream exerting a pressure in only one direction (parallel to the stream velocity). (auth)

17166 EFFECT OF COLLISIONS UPON PLASMA ION OSCILLATIONS. A. F. Kuckes (Princeton Univ., N. J.). Phys. Fluids, 7: 511-19(Apr. 1964). (MATT-176)

The coupling between ion oscillations and electric currents introduced by collisional effects was studied. A growth of ion acoustic waves is found, which extrapolates to the Vlasov gas value as the collision mean free path and wavelength become comparable. The damping of ion acoustic waves is calculated from the fluid equations. For a plasma confined by a strong magnetic field, convective oscillations can be excited by an electron drift along the magnetic field lines. The growth rate and frequency of these oscillations is compared to stellarator experiments. (auth)

17167 IONIZATION RATES AND POWER LOSS FROM θ-PINCHES BY IMPURITY RADIATION. Alan C. Kolb (Naval Research Lab., Washington, D. C.) and R. W. P. McWhirter. Phys. Fluids, 7: 519-31(Apr. 1964).

Calculations are presented for the influence of small impurity concentrations on the energy balance and electron temperature during the magnetic compression of a deuterium plasma. The rate equations that describe the ionization are based on the Corona Plasma Model. Despite the comparatively high electron densities ($\gtrsim 10^{16}$ cm^{-3}) in these plasmas, this model should be applicable because of the high ionic charge at temperatures over ~10 ev. The radial temperature and density distributions were obtained numerically by coupling the Hain-Roberts two-fluid, hydromagnetic equations to the Corona equations. The ionization of up to four different impurities, i.e., C, N, O, Ne, can be taken into account. Radiation losses were included in the electron energy-balance equation, but the influence of impurity ionization on the electron density and electrical conductivity was neglected. Therefore, only small impurity concentrations can be considered. However, only a few percent impurities have a drastic effect on the electron temperature so that the calculations may be meaningful in the interpretation of certain experiments. (auth)

17168 ION DENSITY MEASUREMENT IN A BARIUM PLASMA BY SCATTERING OF RESONANCE RADIATION. Fritz W. Hofmann (Princeton Univ., N. J.). Phys. Fluids, 7: 532-6(Apr. 1964). (MATT-207)

A method for measuring local atom or ion densities, based on the scattering of resonance line radiation, is discussed for the case of an optically thin barium plasma confined by a strong magnetic field. The anisotropy of the flux of scattered resonance radiation due to anisotropic illumination and the presence of a magnetic field is examined. Barium ion density measurements on a laboratory plasma are described. It is noteworthy that this method is capable of high spatial resolution, and that light intensity ratio measurements suffice to obtain absolute ion densities. No absolute photometric measurements are required. (auth)

17169 NONADIABATIC MOTION OF A CHARGED PARTICLE IN AN AXISYMMETRIC MAGNETIC BARRIER. J. Reece Roth (Cornell Univ., Ithaca, N. Y.). Phys. Fluids, 7: 536-43(Apr. 1964).

A study was made of the motion of a single charged particle in the magnetic induction generated by an axisymmetric current sheet, the current of which was sinusoidally modulated along the axis. Several adiabatically invariant quantities were investigated, and it was found that $M_4 = |v \times B|^2/|B|^3$ varied least along a given trajectory. A particle was considered to be adiabatic if M_4 varied by less than 5% during a single interaction with the magnetic barrier.

An averaging process was found which made it possible to predict the relations between particle mass and energy, and the magnetic induction strength and geometry, which cause M_i to vary by more than 5% during a single interaction with the magnetic barrier. Experimental apparatus was constructed that made it possible to study a single interaction of a beam of charged particles with a magnetic barrier under steady-state conditions. An experimental procedure was developed that made it possible to detect the transition from adiabatic to nonadiabatic reflection of the ion beam, and the results were compared with the results of the numerical computation. (auth)

17170 DOPPLER TEMPERATURES IN THE C STELLARATOR. Joseph G. Hirschberg (Princeton Univ., N. J.). Phys. Fluids, 7: 543-7(Apr. 1964). (MATT-200)

A convenient method for the accurate measurement of Doppler temperatures as a function of time was developed and applied to the C Stellarator. General agreement between Doppler and other temperature measures was found when the plasma is quiescent. Late in the period of plasma containment however, the ion-Doppler temperatures begin to fall appreciably below the electron temperature. This is shown to be explainable in terms of an influx of cold gas which tends to overcome the heating by the electrons. (auth)

17171 GUIDING CENTER MOTION AND PLASMA BEHAVIOR IN THE BUMPY TORUS. G. Gibson, W. C. Jordan, E. J. Lauer, and C. H. Woods (Univ. of California, Livermore). Phys. Fluids, 7: 548-56(Apr. 1964). (UCRL-7246)

Drift surfaces of guiding centers in the Bumpy Torus (NSA 17: 19506) static magnetic field were located and analyzed for various torus parameters by making use of the transverse adiabatic invariant $\mu = p_\perp^2/B$ and the longitudinal adiabatic invariant $J = \oint p_{||}\,dl$. In addition, the drift equations (for which μ is an invariant) were solved numerically to investigate limitations on the application of the invariance of J. In general, J is an invariant for the drift equations under adiabatic conditions; however, some special guiding-center trajectories are presented for which the drift per longitudinal period is sufficiently large that the assumption of the invariance of J is not valid. Closed surfaces of constant $U = -\oint B^{-1}\,dl$ were found. These are also surfaces of constant plasma pressure under static equilibrium conditions at low β for a hydromagnetic model. The stability of the equilibrium is discussed. (auth)

17172 ONE-DIMENSIONAL MAGNETOGASDYNAMIC FLOW WITH HEAT TRANSFER. Ching Shi Liu and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill.). Phys. Fluids, 7: 564-7(Apr. 1964).

The case of one-dimensional magnetogasdynamic flow with heat transfer is analyzed. It is shown that the flow variables can be expressed as functions of the dimensionless K number. The important flow regimes are delineated and it is observed that although the flow is reminiscent of classical flow with heat transfer, there do appear significant differences. (auth)

17173 SHOCK TUBE STUDIES OF RADIATIVE TRANSPORT IN AN ARGON PLASMA. R. W. Rutowski (Lockheed Missiles and Space Co., Sunnyvale, Calif.) and D. Bershader. Phys. Fluids, 7: 568-77(Apr. 1964).

An experimental study was made of thermal transport at the stagnation point of a 1-in.-dia. hemisphere-cylinder model immersed in a high enthalpy flow of shock-heated argon. Emphasis was placed on the separation of convective and radiative transport. Variation of operating parameters gave regimes in which (1) the heat transfer was almost wholly of the aerodynamic or convective type, or (2) both convective and radiative heat transfer had to be considered. Separate measurements of the total heat transfer and of the radiative component permitted separation of the former into convective and radiative parts. A limited comparison is made between the convective results and those obtained earlier for nonionized argon. The radiative transport is compared with that obtained theoretically from the Kramers bremsstrahlung theory as applied to an argon plasma. (auth)

17174 FLOW OF A HYDROGEN PLASMA THROUGH A TRANSVERSE MAGNETIC FIELD. Everet H. Beckner (Sandia Lab., Albuquerque, N. Mex.). Phys. Fluids, 7: 586-95(Apr. 1964). (TID-19023)

A study was conducted of the phenomena occurring when a hydrogen plasma is caused to flow through a transverse magnetic field. Plasma polarization effects were studied as well as the deceleration processes that occurred when large currents were extracted from the plasma. Standing "wedge-shaped" shock waves were observed when sufficient current was extracted to permit the deceleration phenomena to be manifested. The effective plasma resistance between electrodes was determined, and a correlation made with plasma conductivity measurements, including boundary layer effects. A determination was made of the power and energy extracted from the plasma. (auth)

17175 INTERFEROMETRIC ANALYSIS OF AXISYMMETRIC PLASMA FLOW. G. D. Kahl and E. H. Wedemeyer (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Phys. Fluids, 7: 596-601(Apr. 1964).

Experimental results of applying the method of two-wavelength, streak interferometry are given for the cylindrical, time-dependent flow of ionized argon produced by an exploding wire. Measurements from simultaneous streak interferograms at wavelengths 5460 and 4358 Å are used to determine contour charts of electron concentration and mass density of the shock-arc-heated argon plasma. Where thermal equilibrium can be assumed, values of velocity, pressure, and temperature can be deduced. The resulting temperatures agree well with those obtained from the Saha relation at the measured degree of ionization. The reduction equations and assumptions needed for the axisymmetric analysis are given. An estimate is made of the error in measured mass density caused by multiple ionization. (auth)

17176 SUPERSONIC PLASMA STREAMS SEEDED WITH ELECTRONEGATIVE GASES. Allan I. Carswell and Giles G. Cloutier (RCA Victor Research Labs., Montreal). Phys. Fluids, 7: 602-8(Apr. 1964).

An experimental study of the properties of supersonic plasma streams, which were seeded with small amounts of an electronegative gas, is described. It was found that striking reductions of the electron and ion densities of the plasma can be achieved using sulfur hexafluoride (SF_6) as the seed gas. The properties of seeded argon streams at pressures of 1 torr and velocities of about Mach-2 were studied using double-probe and microwave (9.2 Bc/sec) scattering techniques. The results show that when the SF_6 is introduced with a concentration of only 5×10^{-4} relative to that of the argon in the stream, the plasma is quenched almost completely. Under these conditions the reflection of microwaves from the stream is reduced by 20 db and the probe measurements show the presence of the "hole" cut in the plasma by the SF_6. Measurements of seedling with argon, nitrogen, and oxygen in the argon streams are also discussed. (auth)

17177 SPECTROSCOPIC DETERMINATION OF ELECTRON TEMPERATURE AND PERCENTAGE IONIZATION

IN A HELIUM PLASMA. Ronald J. Sovie (Lewis Research Center, Cleveland). Phys. Fluids, 7: 613-14(Apr. 1964).

A spectroscopic diagnostic technique is described for determining electron temperature that is valid for a low-pressure, high-temperature plasma with local thermodynamic nonequilibrium. The method uses the observed excitation cross sections for certain helium singlet and triplet spectral lines that are known over a range of electron energies. A Maxwellian electron velocity distribution is assumed for the averaged cross sections. The intensity ratio of the spectral lines, from the ratio of the averaged cross sections, is plotted versus electron kinetic temperature. (R.E.U.)

17178 EFFECT OF A TRANSVERSE MAGNETIC FIELD ON MAGNETIC SURFACES IN A STELLARATOR WITH HELICAL WINDINGS. Dieter Eckhartt (Princeton Univ., N. J.). Phys. Fluids, 7: 615-16(Apr. 1964). (MATT-197)

Experiments are described using the Etude Stellarator that show that the superposition of a small uniform magnetic field directed transverse to the plane of the torus does not destroy the magnetic surfaces in a stellarator, but shifts them at right angles to the transverse field. (R.E.U.)

17179 INFLUENCE OF IMPURITIES ON A HIGH TEMPERATURE, HIGH DENSITY DEUTERIUM PLASMA. P. Bogen, E. Hintz, and J. Schlueter (Kerforschungsanlage, Julich, Ger.). Phys. Fluids, 7: 616-18(Apr. 1964).

The effects of a carbon impurity (CH_4) in a θ-pinched deuterium plasma were investigated. The electron temperature and radiation intensities were measured. (R.E.U.)

17180 ELECTRON OSCILLATIONS IN A NONUNIFORM BOUNDED PLASMA IN A STRONG MAGNETIC FIELD. B. K. Sachdeva (Indian Inst. of Tech., Kanpur) and S. K. Trehan. Phys. Fluids, 7: 618-20(Apr. 1964).

High-frequency electron oscillations in a nonuniform plasma slab and cylinder in the presence of an external magnetic field were studied. Density gradients that exist in a direction perpendicular to the lines of force of the magnetic field are considered. (R.E.U.)

17181 COMMENTS ON "CONVECTIVE FLEXURE OF A PLASMA CONDUCTOR." James A. Fay (Massachusetts Inst. of Tech., Cambridge). Phys. Fluids, 7: 621-2(Apr. 1964).

A previous paper discussing the equilibrium position of a thermal arc in a steady convective flow (NSA 17: 36783) is shown to include an unnecessary assumption about isothermal surfaces that include the electric field and current lines. (R.E.U.)

17182 STUDIES OF THE DYNAMIC PROPERTIES OF LANGMUIR PROBES. I: MEASURING METHODS. R. W. Carlson, T. Okuda, and H. J. Oskam (Univ. of Minnesota, Minneapolis). Physica, 30: 182-92(Jan. 1964).

Three different measuring techniques are presented for use in the study of the transient behavior of Langmuir probes, immersed in a gaseous plasma. These techniques make it possible to study the dynamic behavior of positive and negative space-charge sheaths. A special type of Langmuir probe required for these studies was developed and the precautions that have to be taken with respect to the various components of the measuring circuit are discussed. Plasma phenomena observed when suddenly changing the potential of the probe with respect to the plasma are described. (auth)

17183 STUDIES OF THE DYNAMIC PROPERTIES OF LANGMUIR PROBES. II: EXPERIMENTAL RESULTS. T. Okuda, R. W. Carlson, and H. J. Oskam (Univ. of Minnesota, Minneapolis). Physica, 30: 193-205(Jan. 1964).

Results obtained with the pulsed probe, the high-frequency probe, and the static probe-time varying plasma methods are presented. The studies showed that for the highly negative probe the influence of the displacement current spike due to the probe-plasma sheath capacitance is dominant. The magnitude of this capacitance was found to increase with increasing plasma density as can be expected. Large delays in the collection of electrons by the probe were observed for final probe potentials close to plasma potential. The magnitude of the delay effect decreases for increasing plasma density and/or increasing value of the mobility of the charged particles in the gas. The results obtained with the pulsed probe and the high-frequency probe were consistent, while the phenomena observed during the static probe-time varying plasma method could easily be explained. (auth)

17184 COLLISIONAL-RADIATIVE RECOMBINATION AT LOW TEMPERATURES AND DENSITIES. D. R. Bates (Queen's Univ., Belfast) and A. E. Kingston. Proc. Phys. Soc. (London), 83: 43-7(Jan. 1964).

The collisional-radiative recombination coefficient in cool tenuous $H-H^+-e$ plasmas is calculated by a new approximate method. It is found that if the electron temperature T_e is low, collisional effects are important even when the electron density n(c) is small: thus if T_e is 25°K and n(c) is 1×10^3 cm^{-3}, α is almost 1.5×10^{-10} cm^3 sec^{-1} which is about 7 times the radiative recombination coefficient. Other approximate methods are discussed. (auth)

17185 A SPECTROSCOPIC DETERMINATION OF ELECTRON TEMPERATURE IN A HIGH TEMPERATURE PLASMA. L. Heroux (Culham Lab., Berks, Eng.). Proc. Phys. Soc. (London), 83: 121-36(Jan. 1964). (CLM.P-30)

The electron temperature of a high temperature plasma is determined by measuring the intensity ratio of the $2s-2p$ and $2s-3p$ transitions in the same Li-like ion. The theoretical dependence of the intensity ratio on electron temperature is given for several Li-like ions between C IV and Si XII. It is assumed that the free electrons have a Maxwellian distribution of velocities and that the distribution of electron populations over the bound levels is given by a coronal-type equation. A collisional excitation cross section derived by Seaton is used. The use of spectral lines emitted by the same ion and with a common lower level gives an intensity ratio that is a function of electron temperature only and is free from several ambiguities that may arise from spatial and temporal variations. The method can be used for measurements of electron temperature between about 5 and 200 ev. This method was used to determine the electron temperature of the pulsed deuterium plasma in ZETA over a wide range of conditions by measuring the intensity ratio of the N V 1238.8 and 209.3 Å lines photoelectrically with a grazing-incidence monochromator. A relative photometric calibration was obtained, firstly from the known relative photoelectric yield of a tungsten reference cathode, and secondly by using the branching ratio method with the He II ion. The errors in the measurement of electron temperature arising from random and systematic errors in the measurement of the intensity ratio are also discussed. (auth)

17186 THE COLLECTION OF POSITIVE IONS BY A PROBE IMMERSED IN A PLASMA. J. E. Allen (Euratom-CNEN, Frascati, Italy) and A. Turrin. Proc. Phys. Soc. (London), 83: 177-9(Jan. 1964).

The numerical calculations, which refer to a spherical

probe immersed in a low pressure plasma, were extended to cover a wider range of parameters. (auth)

17187 WHISTLER-MODE PROPAGATION IN A LABORATORY PLASMA. A. N. Dellis and J. M. Weaver (Culham Lab., Berks, Eng.). Proc. Phys. Soc. (London), 83: 473-89(Mar. 1964).

Propagation of 9280-Mc electromagnetic radiation through an argon afterglow plasma was studied. A superimposed uniform magnetic field, parallel to the direction of propagation, was set at values between 1800 and 6800 gauss. The electron density and temperature throughout the plasma were measured with a Langmuir double probe. The propagation was observed for electron densities exceeding the critical value for 9280 Mc by more than 50 times, but only when the applied magnetic field exceeded the electron cyclotron resonance value. The amplitudes of the right-hand and left-hand circularly polarized components of the propagated signal were measured separately, and changes of plasma refractive index were recorded interferometrically. Both the polarization and refractive index observations were found to agree with the predictions for the whistler mode from Appleton's equation, excluding the Lorentz term. The collisional absorption predicted by this equation accounts quantitatively for the failure to obtain propagation when the electron density is very high. (auth)

17188 HIGH-FREQUENCY FIELD STRENGTH MEASUREMENTS IN A PLASMA BY MEANS OF THE STARK EFFECT. E. V. Lifshits, S. S. Krivulya, and V. S. Us (Inst. of Physics and Tech., Khar'kov). Ukr. Fiz. Zh., 8: 1328-34(1963). (In Ukrainian)

Field strength measurements were carried out in the high-frequency field formed by an external source in a plasma waveguide located in a magnetic field. The dependence of the field strength on the high-frequency power introduced into the plasma waveguide was investigated. The field strength is determined by the broadening of the H_β line due to the Stark effect in the high-frequency field. The photoelectric method was used for light signal recording, and an electronic system was employed for synchronizing the high-frequency pulse with the elements of the recording circuit. (auth)

17189 VOPROSY TEORII PLAZMY. VYPUSK 3. (Problems in Plasma Theory. Number 3). M. A. Leontovich, ed. Moscow, Gosatomizdat, 1963. 292p.

Four articles are presented on linear plasma oscillations and the theory of weakly turbulent plasma. Oscillations and their interactions with charges in homogeneous plasma are analyzed. Heterogeneous plasma instability in magnetic fields and effects of developing oscillations on the charge distribution function are discussed. Effects of developing oscillations on charge distribution and interaction of plasma waves are investigated. Data are also given on symmetric magnetohydrodynamic flow. (R.V.J.)

17190 SOME CHARACTERISTIC FEATURES OF ČERENKOV RADIATION, SURFACE WAVES AND LEAKY WAVES EXCITED BY MOVING CHARGED PARTICLES IN CYLINDRICALLY STRATIFIED MEDIA. M. Yildiz (Raytheon Co., Wayland, Mass.) and K. U. Ingard. p.492-501 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

Excitation of Čerenkov radiation, surface waves, and leaky waves by a uniform motion of charged particles along the axis of a cylindrically stratified region composed of two dielectrics, one of which may represent a plasma, have been investigated. (auth)

17191 SOME PRELIMINARY RESULTS OF THE PLASMA PROBE EXPERIMENTS ON THE SATELLITE ARIEL. A. P. Willmore, R. L. F. Boyd, and P. J. Bowen (Univ. London). p.517-22 of "Proceedings of the International Conference on the Ionosphere." London, The Institute of Physics and the Physical Society, 1963.

A description is given of the plasma (or Langmuir) probe equipment on the satellite Ariel, together with preliminary results obtained using these techniques. Typical spectra for H^+, He^+, and O^+ are given, and the height distribution of the various ions is discussed. (auth)

17192 AN INTRODUCTION TO PLASMA PHYSICS. W. B. Thompson. ADIWES International Series in Advanced Physics. Reading, Mass., Addison-Wesley Publishing Co., Inc., 1962. 263p. $11.50.

Primary consideration is given to the theory of the motions in a fully ionized gas, including the electromagnetic response. The book includes a chapter on the partially ionized arc plasma, three chapters on MHD that contain discussions of plasma containment, plasma stability, propagations of small oscillations, shock waves, direct conversion of thermal into electrical energy and plasma propulsion for interplanetary travel. The classical derivation of transport coefficients, the basis of the Fokker-Planck equation, propagation of electromagnetic waves, and the theory of the collisionless plasma are considered in a kinetic theory. (R.E.U.)

17193 COLLISIONAL PROCESSES IN HELIUM PLASMAS AT CRYOGENIC TEMPERATURES. P. D. Goldan and L. Goldstein (Univ. of Illinois, Urbana). p.1-4 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

An experiment was devised to measure the electron-atom momentum transfer cross section in helium for electron energies of the order of 10^{-3} ev. Microwave techniques were used to probe the afterglow of a helium discharge created in an apparatus immersed in a liquid helium bath at 4.2°K. At times when the indicated electron temperature was 300°K, the conductivity measurements gave a cross section for momentum transfer in good agreement with other workers. The results of the conductivity measurements for times after cessation of the active discharge when the indicated electron energy was approximately 2×10^{-3} ev gave a value for the cross section of 1.7×10^{-15} cm^2. (M.C.G.)

17194 CASCADE PROCESSES IN ENERGETIC NEUTRON HYDROGEN BEAMS. John R. Hiskes (Univ. of California, Livermore). p.99-104 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Excitation processes are discussed for the case of an excited energetic atom beam impinging on a magnetically confined plasma. The successive collisional excitations among the excited states generated an inverted cascade of the population distribution, which was terminated by the Lorentz ionization of some upper level. The Born cross sections are presented for all dipole excitations which can occur in a Stark field for levels up to n = 10. Criteria are presented for the production of dense energetic plasmas generated by an inverted cascade and the Lorentz ionization of the excited level population of an energetic neutral hydrogen beam. (auth)

17195 QUANTUM AND EXCHANGE CORRECTIONS TO PLASMA KINETIC THEORY. Paul H. Levine (California Inst. of Tech., Pasadena). p.173-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

By means of a quantum-mechanical phase space distribution function introduced by von Roos, the Schroedinger equation appropriate to a plasma can be transformed into a quantum mechanical generalization or the Liouville equation. From the consequent analog of the BBGKY hierarchy, the two-electron correlation function in a spatially homogeneous fully ionized plasma is obtained by assuming that the ions can be treated as an immobile uniformly charged background. The resulting equation for the electron distribution function is a quantum mechanical Boltzmann equation, whose collision integral differs from that derived by Balescu and others in that exchange effects are more properly taken into account. In particular, a term appears in the collision integral that is identifiable with the Mott correction to electron-electron scattering, and is shielded by the dynamical dielectric constant of the plasma in a somewhat unexpected fashion. A consequence of this term is an alteration of the large momentum transfer contributions to the collision integral appropriate to a "classical" plasma. (auth)

17196 ON THE SUPERKINETIC EQUATION FOR SPATIALLY-HOMOGENEOUS PLASMAS. James E. McCune (Institut für Plasmaphysik, Munich and Massachusetts Inst. of Tech., Cambridge). p.177-82 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A derivation from the Liouville equation of the equations describing the irreversible evolution of the N-momenta distribution function for a classical spatially homogeneous plasma ($nr_D^3 \gg 1$) is given. Collective effects are included. This "superkinetic" description reduces to the weak-coupling "master equation" of Brout and Prigogine when collective effects are neglected. The results are given in terms of a closed, coupled set of equations analogous to those obtained by Bogoliubov for the kinetic description of a plasma. The conditions under which this system reduces to Bogoliubov's, and hence to the kinetic equation of Balescu and Lenard, were derived. The origins of irreversibility in plasmas are discussed in the light of this and other work. (auth)

17197 QUANTUM MECHANICAL TREATMENT OF CORRELATIONS IN A PLASMA. Marc R. Feix (Institut für Plasmaphysik, Munich). p.185-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The quantum treatment of correlations in an electron plasma (plus a neutralizing background) at thermal equilibrium was studied. Spin correlations and relativistic corrections were neglected and the mean distance of closest approach was supposed much smaller than the mean De Broglie wavelength λ. Both correlations in space and time were examined. It was found that in the wave formalism a large wavenumber cutoff is automatically provided at λ^{-1} in addition to the usual small wavenumber cutoff at the inverse of the Debye length. Connection was established with the Rutherford cross section problem. (auth)

17198 CORRELATION FUNCTION IN A PLASMA OUTSIDE EQUILIBRIUM. Marc Feix and Pieter Schram (Institut für Plasmaphysik, Munich). p.189-91 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A one species homogeneous plasma was studied outside equilibrium. The Fourier transform in space of the density correlation $G(\vec{k})$ was computed by two different methods and the result connected with the fluctuation spectrum of the electric field. Integrals involved in the general method were evaluated for small k. This result introduced a limitation on the behavior of the velocity distribution for large velocities. $G(\vec{k})$ was used to compute the interaction part of the equation of state. (auth)

17199 KINETIC EQUATION FOR A PLASMA IN A MAGNETIC FIELD. Pieter Schram (Institut für Plasmaphysik, Munich). p.193-4 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A derivation is given of the kinetic equation for a homogeneous plasma in a constant external magnetic field by means of the weak coupling expansion of the BBGKY equations. Although collective effects were not taken into account by this procedure, the collision integral converged for large interaction distances. If the Larmor radius r_c was much larger than the distance of closest approach r_L the Landau equation was obtained with the Coulomb logarithm $\ln r_c/r_L$. This result is reasonable, if $r_c <$ Debye length. (auth)

17200 PLASMA OSCILLATIONS WITH COLLECTIVE CORRELATIONS. C. M. Tchen (National Bureau of Standards, Washington, D. C.). p.195-9 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Longitudinal oscillations in an unbounded, rarefied plasma were studied by including the effects of the correlation function. Since it is the collective behavior in the plasma that sets up the oscillations, its roles both in the singlet distribution function and in the pair correlation function were investigated. Thus the fundamental equations governing the plasma oscillations are proposed to be the Poisson equation determining the collective field, the BBGKY equation determining the singlet distribution function, and the kinetic equation of the Vlasov type determining the correlation function. The system was linearized. The dispersion relation for oscillations was obtained, and the Landau damping was calculated. (auth)

17201 THEORY OF PLASMA OSCILLATIONS WITH PAIR CORRELATIONS. Ching-Sheng Wu and Edward H. Klevans (California Inst. of Tech., Pasadena). p.201-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Effects of electron-ion and electron-electron correlations on plasma oscillations were studied by obtaining an approximate solution for the first two members of the BBGKY hierarchy. Electron-ion correlations are shown to be especially important, for they produce, in the long wavelength limit a damping independent of wave number k and a small correction to the plasma wave frequency that is independent of wavelength and thus modifies the Langmuir plasma frequency. The damping, which is wavelength independent, predominates over Landau damping and is in close agreement with the damping obtained from high frequency conductivity calculations. For both the damping and the dispersion relation, electron-electron correlations were found to appear first in terms proportional to k^2. These terms, as well as the k^2 terms from electron-ion correlations, were also computed. Results were compared with those obtained previously. (auth)

17202 LONGITUDINAL DIELECTRIC CONSTANT OF A FULLY IONIZED PLASMA, CONTAINING THE EFFECT OF THE CORRELATIONS-EQUILIBRIUM CORRELATION FUNCTION. J. Coste (Faculté des Sciences, Orsay, France). p.209-11 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Starting from the two first kinetic equations of the

BBGYK group, and using the formal solution of Guernsey, the dielectric constant of the plasma, $\epsilon(\underline{k},\omega)$, was derived. From $\epsilon(\underline{k},0)$ the equilibrium correlation function was obtained. (auth)

17203 INSTABILITIES DUE TO RADIATION. P. Nelson (Commissariat à l'Énergie Atomique, Paris). p.213-14 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The influence of the Compton effect produces instability in any transparent medium developed into a low-density plasma. Electron temperature cannot exceed a limit that is a function of density. When, at very low densities, radiation by acceleration becomes the main effect, it was concluded that the density will have to be kept under a maximum. (auth)

17204 CONTINUUM DESCRIPTION OF A HIGH-TEMPERATURE PLASMA. Lewis S. Klein and Julius L. Jackson (National Bureau of Standards, Washington, D. C.). p.215-16 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The equilibrium properties of a classical plasma are discussed in terms of the net charge density, considered as a continuous function of position. The thermodynamic functions were obtained from the fluctuations of this net charge density function. In particular, the probability distribution function of the potential at a point was obtained, as well as the joint probability distribution function of the potential at two points. Using general statistical mechanical relationships, it was then possible to calculate the chemical potential and the two particle distribution function. It is shown that this continuum description is equivalent to Debye-Hückel theory. The result of including a first order correction to the continuum picture by treating the nearest neighbor as a discrete charge, and the rest of the plasma as a continuum, yielded results of the same form as those obtained by the more usual diagrammatic techniques with the nodal expansion of the Mayer cluster integrals. (auth)

17205 THE MICROFIELD OF A PLASMA AND ITS INFLUENCE ON THE IONIZATION. A. Schlueter (Max-Planck-Institut für Physik und Astrophysik, Munich and Institut für Plasmaphysik, Munich). p.217 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

It is shown that in all ordinary plasmas the region around any charged particle within which the dynamics can be treated classically (i.e. nonquantized) and the region in which many-particle interactions are negligible overlap. Therefore it must be partly treated as a classical many-body problem and partly as a quantized two-body problem and then fit together. Using this approach the ionization equilibrium of a plasma was treated and a correction to the Saha equation was deduced. (auth)

17206 ON THE DIVERGENCE PROBLEM OF THE PARTITION FUNCTION AND THE IONIZATION POTENTIAL REDUCTION IN PLASMA. R. W. Larenz (Technische Hochschule, Hanover). p.219-20 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Starting from the conception, that a sharp discrimination between highly excited bound electron states near the ionization boundary and free electron states will not be possible, a simple heuristic treatment is presented. It consists in the postulate, that the density distribution of states, considered as function of energy, passes steadily and with steady gradient through the boundary region between bound and free states. This is possible on account of the fact that the states near the ionization boundary are broadened to a continuous distribution of energy terms. The result of the simple calculation for a hydrogen-like structure of the highly excited states was compared with an earlier treatment by Unsöld. (auth)

17207 THE PARTITION FUNCTION OF A FULLY IONIZED GAS. Karl Ulrich von Hagenow (Max-Planck-Institut für Physik und Astrophysik, Munich) and Heinz Koppe. p.221-3 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A classical plasma in thermodynamic equilibrium does not exist, the partition function diverges because of the singularity of the Coulomb potential. By using a method invented by Kirkwood, it is shown that in the classical limit the quantum mechanical function goes over into the classical expression, with an effective potential replacing the Coulomb interaction. The effective potential was derived and found to deviate from the Coulomb potential only up to the distance of the thermal de Broglie wavelength. It yielded an existing integral over phase space for the partition function. (auth)

17208 LOWERING OF THE IONIZATION ENERGY FOR A PLASMA WITH DIFFERENT TEMPERATURES OF THE PARTICLE COMPONENTS. G. Ecker and W. Kroell (Universität, Bonn). p.227-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The problem of the lowering of the ionization energy due to Coulomb interaction was widely investigated for a plasma in thermodynamic equilibrium. The same problem for the case of a stationary multicomponent system with different temperatures of the components is treated. By use of irreversible thermodynamics a generalized ionization formula was derived. The lowering of the ionization potential expressed in terms of the chemical potentials was calculated with the help of the average micropotential via Güntelberg's charging process. It is given as a function of temperatures and densities. (auth)

17209 DEPARTURES FROM LOCAL THERMODYNAMIC EQUILIBRIUM IN A FULLY IONIZED GAS. Ludwig Oster (Yale Univ., New Haven). p.235-6 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A general formulation of the problem of departures from local thermodynamic equilibrium (LTE) in the case of a fully ionized gas, where the electrons' energy states are continuous, was derived. The resulting relations, defining the mutual dependence of radiation field and particle distribution functions, were exceedingly complex. It was possible, however, to deduce some general rules for steady states and for plasmas in which the energy distribution function of free electrons is not dominated by the radiation field. In addition, results are presented that describe the time-change of an initially given distribution function due to radiative transitions in an approximation in which the radiation field can be treated as a small perturbation. (auth)

17210 MACROSCOPIC EXCHANGE OF QUANTITY OF MOVEMENT AND ENERGY BETWEEN ELECTRONS AND IONS, BY COLLISIONS, IN FLOWING PLASMA. Jean-Michel Dolique (Centre de Physique Electronique et Corpusculaire, Orsay, France). p.237-40 of "VI^e Conference

Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The macroscopic exchange of movement and energy between electrons and ions in a flowing plasma was studied. Slowing and diffusion of individual particles, equations for energy and movement exchange, Coulomb collisions as method of exchange, and applications of the equations for strongly ionized plasmas are discussed. (M.C.G.)

17211 ANALYTICAL STUDY OF SLOWING DOWN OF CHARGED PARTICLES IN PLASMA. Richard Daniel (Commisaariat à l'Énergie Atomique, Paris). p.241-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The energy loss of fast ions in a Maxwellian plasma was considered as a function of time. The mean instantaneous energy variation dE/dt, as given by Boulègue, was used and compared with the expression derived from Chandrasekhar diffusion coefficients. A simplified expression for dE/dt was proposed, which can be integrated. With the hypothesis that the diffusion in velocity space is neglected, equations were obtained, which describe approximately the energy loss vs time of fast ions in a gas of ions, or electrons, and in a plasma. (auth)

17212 CALCULATION OF THE PROPERTIES OF A NON FULLY IONIZED PLASMA. C. B. Wheeler (Imperial Coll. of Science and Tech., London). p.247-51 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A technique for calculating the composition of a plasma formed from one chemical element is described. A three-component composition is a good approximation and the kinetic theory of such a mixture was developed. The diffusion of internal energy was considered in some detail and shown to be negligible for the single-element plasma. However, the effect may be important if ions of widely differing masses are present. The results were applied to argon in the pressure and temperature range of 1μ to 100 atm. and 10,000 to 200,000°K. (auth)

17213 THE FLAME PLASMA. A. von Engel and J. R. Cozens (Oxford Univ.). p.257-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The physical properties of the reaction zone in a flame plasma and mechanism of the transfer of the chemical combustion energy into heat are discussed. (M.C.G.)

17214 ON THE HEATING OF ELECTRONS IN CROSSED ELECTRIC AND MAGNETIC FIELDS. Wulf B. Kunkel and Gary A. Pearson (Univ. of California, Berkeley). p.259-62 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The velocity distribution of electrons in a very weakly ionized gas under many conditions tends to be nearly isotropic even in the presence of electric and magnetic fields. It is shown that in such cases the rate of electron heating can be represented as a spherically symmetric diffusion in velocity space without the usual restriction to steady-state conditions. In the case of a steady electric field perpendicular to a strong magnetic field, the pertinent velocity-diffusion coefficient has the form $D = v_d^2\nu/3$, where $v_d = cE/B$ is the drift speed and ν is the momentum transfer collision frequency. (auth)

17215 THE INFLUENCE OF METASTABLE ATOMS ON THE POPULATION OF EXCITED STATES IN A THERMAL PLASMA. L. E. Brewer and W. K. McGregor (Arnold Engineering Development Center, Tullahoma, Tenn.). p.263-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Spectral line emission was shown to be strongly influenced by the existence of metastable states in plasmas. The distribution function for excited electronic states in a thermal plasma in which a constant density of metastable atoms is present was derived by the establishment of a suitable model. This was accomplished by considering two different atoms which are identical except for their zero energy states. A Boltzmann distribution function was written for each type of atom for the upper energy states, and the two distributions were summed to obtain the population of the n^{th} state due to both the normal and metastable atoms. Using argon as an example, calculations are presented, which show that the population of a given excited state may be several orders of magnitude greater than that which would be expected if metastable atoms were not present. When including this term in the Einstein-Boltzmann spectral line intensity equation, it is seen that intensities are considerably altered when even a slight concentration of metastable atoms is present. (auth)

17216 RE-EXAMINATION OF THE CRITERIA FOR THERMAL EQUILIBRIUM IN ELECTRICAL DISCHARGES. W. K. McGregor and L. E. Brewer (Arnold Engineering Development Center, Tullahoma, Tenn.). p.267-72 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Criteria such as Compton's E/P relationship, were used to infer equilibrium for certain electrical discharges. These criteria, based on classical collision theory, resulted from a particular solution of the uniform field, electron energy equation for contained discharges, considering only elastic collisions, and are well supported by experimental evidence under conditions of applicability. A re-examination of the criteria (brought about by conflicting experimental evidence) revealed that the heavy particle flow through the discharge, ignored in the past, must be considered for certain types of discharges. New criteria were derived, based on a more complete treatment of the differential equations for collisional energy transfer in a discharge and allowing for heavy particle flow in a pressure field, which express the conditions required for equilibrium in terms of E/N and Δt, where N is the heavy particle density and Δt is the dwell time of the heavy particles in the discharge. These results served to support the concept of a two-temperature flowing discharge. (auth)

17217 RELAXATION OF ELECTRON AND ION TEMPERATURES IN A STRONG MAGNETIC FIELD. D. Voslamber (Euratom-CEA, Fontenay-aux-Roses, France). p.273-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The rate of relaxation between electron and ion temperatures is increased by the presence of a magnetic field when the mean gyration radius of the electrons is smaller than the Debye length. The main effect of the magnetic field is to enhance the spatial correlation between electrons and ions by preventing the electrons from moving away in directions perpendicular to the field. The relaxation rates calculated for low densities and high ion temperatures agreed with those recently derived by Silin, but for high densities and low ion temperatures they were found to be smaller. Deviations up to a factor of two occurred when the results were applied to the energy transfer between electrons and heavy ions. (auth)

17218 ABSORPTION COEFFICIENT AND MICROWAVE CONDUCTIVITY OF ISOTROPIC PLASMAS. P. Mallozzi and H. Margenau (Yale Univ., New Haven). p.277-9 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The relation between conductivity and absorption in slightly ionized plasmas was examined. (M.C.G.)

17219 A NEW THEORY OF THE MOBILITY OF IONS AND ELECTRONS. J. Salmon (Université, Caen, France). p.321-9 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

From a method of moments the functions of the distribution of ions and electrons in a weakly ionized plasma can be obtained. The mobilities and temperatures can be deduced and compared with experiments. (auth)

17220 DRIFT VELOCITY OF ELECTRONS IN HELIUM AT HIGH E/P. R. A. Stern (Bell Telephone Labs., Inc., Whippany, N. J.). p.331-3 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The drift velocity of electrons in helium at 300°K was measured for $10 \leq E/P \leq 300$ v/cm–torr. The experiments were performed on the positive column of a low-pressure discharge by performing simultaneous measurements of the electron density and the discharge current. The increase in mobility in the range $13 \leq E/P \leq 40$ reported by Phelps et al peaked at $E/P \approx 90$, and decreased at higher values of E/P. At highest E/P, drift energies of 10 ev were measured, indicating that the electron distribution function is strongly anisotropic in qualitative agreement with the calculations of Baraff and Buchsbaum for hydrogen. (auth)

17221 ON THE MOVEMENT OF POSITIVE IONS IN INHOMOGENEOUS ELECTRIC FIELD. G. Ciobanu and Iovitzu Popescu (Inst. for Atomic Physics, Academy of the R.P.R., Bucharest). p.335 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A kinetic analysis of the movement of positive ions through the positive space charge sheath for plane, cylindrical, and spherical geometries is given. (auth)

17222 THE CONDUCTION OF ELECTRICITY BETWEEN ELECTRODES IN SHOCK-HEATED ARGON. D. G. Fearn, J. Cooper, and H. J. Pain (Imperial Coll. of Science and Tech., London). p.347-52 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Voltage-current characteristics were obtained for electrodes immersed in an argon plasma produced in an electromagnetic shock tube. These indicated the existence of two main conduction regimes. The first regime is described in terms of a current limited by "ionic mobility," and the second, which requires electron production at the cathode, is consistent with electron conductivity theories. (auth)

17223 TRANSPORT PROPERTIES OF A FULLY-IONIZED, LOW-TEMPERATURE PLASMA. N. Rynn (Princeton Univ., N. J.). p.353-6 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The transport properties of a fully ionized alkali metal plasma were investigated in the Q-1 device. The Q-1 device generates a low-temperature alkali-metal plasma by utilizing hot tungsten plates to ionize the alkali metal, in this case potassium, to supply electrons and to confine the plasma axially. A strong magnetic field confines it radially. Application of a potential between the two plates produces a current through the plasma that heats it and causes a potential gradient. By use of the plasma transport coefficients as calculated by Spitzer and Härm, it can be shown that at low current densities the volt-ampere characteristic should yield the electrical and thermal conductivities of the plasma along the magnetic field. It also can be shown that at low current densities the sheaths in front of the plates have negligible effect upon the results, provided that the length of the plasma is very much greater than the ion-electron collision distance. Measurements show good agreement between theory and experiment for the electrical conductivity and for the thermal conductivity. The transport equations were solved for all values of current, and further comparisons were made between theory and experiment. The analysis and measurements described are an extension of previously reported work. (auth)

17224 ABNORMAL RESISTIVITY OF PLASMA. J. C. Boulassier, M. Clement, J. Cuvellier, M. Dagai, and C. Manus (CEN, Saclay, France). p.359-60 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

Measurements of electron temperature as well as densities of neutral and charged particles on a hollow cathode discharge lead to a calculation of the resistivity from theory, which showed a discrepancy with that obtained from direct measurement of the electric field and current density. (auth)

17225 THERMAL CONDUCTIVITY TENSORS FOR WEAKLY IONIZED AIR. Arne A. Wyller (Inst. of Theoretical Astrophysics, Oslo). p.361-7 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The true, ordinary and effective thermal conductivity tensors were evaluated with the requirement that the collision frequency, ν, between electrons and neutral nitrogen molecules varies as the electron velocity squared. Generally speaking the magnetic field inhibits more effectively thermal conduction across the field than was anticipated on the basis of a constant collision frequency. This is particularly the case for the flow direction perpendicular both to the magnetic field and the temperature gradient. Order of magnitude differences arise between the results from the two theories. (auth)

17226 NON-LINEAR AMBIPOLAR DIFFUSION ACROSS A MAGNETIC FIELD. K.-B. Persson and E. R. Mosburg, Jr. (National Bureau of Standards, Boulder, Colo.). p.375-7 of "VI[e] Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The Boltzmann moment equations for a slightly ionized, diamagnetic, isothermal plasma imbedded in an external magnetic field were solved, including all non-linear terms, for both plane-parallel and infinite cylindrical configurations. Bohm's criterion emerged naturally from the equations. As the magnetic field was increased, the density at the boundary was depressed and the centroid of the density distribution was shifted toward the center of the plasma. In all cases, however, the plasma remained bounded by the wall, i.e., the plasma density remained a monotonic function of the position coordinate for all values of the magnetic field. (auth)

17227 EXPERIMENTAL INVESTIGATION OF CHARGED PARTICLE DIFFUSION IN A MAGNETIC FIELD. A. I. Anissimov, V. N. Boodnikov, V. E. Golant, V. N. Sheelin, N. I. Vinogradov, and A. P. Zhylinskii (Ioffe Physico-Technical Inst., Academy of Sciences, U.S.S.R.). p.395-8 of "VI[e] Conference Internationale sur les Phe-

nomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Results of an experimental investigation of plasma decay in cylindrical bulbs 0.4 to 8 cm in diameter at helium pressures of 0.01 to 1 mm Hg with concentration of charged particles ranging from 10^8 to 10^{12} cm^{-3} and magnetic field strengths up to 6000 gauss are presented. To determine the variation in time and spatial distribution of the concentration of charged particles, the cavity, waveguide, and free space microwave methods were used. This investigation permitted data to be obtained on transverse diffusion of charged particles of a plasma in a magnetic field. It was found that under certain conditions the coefficient of diffusion may be considerably larger than might be expected from theoretical relations describing diffusion in a stable plasma. (auth)

17228 PARTICLE LOSSES OF A CESIUM PLASMA IN A STELLARATOR. N. D'Angelo, D. Dimock, J. Fujita, G. Grieger, M. Hashmi, and W. Stodiek (Max-Planck-Institut für Physik und Astrophysik, Munich). p.399-403 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Cesium plasmas in linear geometries exhibited classical diffusion. The particle losses of a cesium plasma in a stellarator geometry were investigated. Measurements were made both in simple toroidal magnetic fields up to 20 kilogauss and also with a rotational transform produced by helical windings. These windings yielded a transform of 82° at a radius of 2.2 cm, the theoretical aperture. The plasma was produced by thermal ionization of cesium atoms on a hot tantalum surface about 4 mm in diameter, located on the axis of the magnetic field. Measurements were made of the total flux of ions from the tantalum surface and the density and "floating potential" distributions were obtained by means of Langmuir single and double probes. The flux and the density measurements were checked using independent methods. The observed loss rates appeared to be several orders of magnitude larger than those expected from classical diffusion over a range of densities, on the axis, from about 10^8 to 10^{11} cm^{-3}. (auth)

17229 THERMAL INSTABILITY OF THE PLASMA COLUMN. G. Ecker, W. Kroell, and O. Zoeller (Universität, Bonn.). p.405-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A cylindrical collision dominated plasma column with particle production by electron collisions and without volume recombination was considered. The instability of such a column in a longitudinal magnetic field was treated by several authors under the assumption that a density disturbance does not cause a temperature disturbance. In this investigation the thermal instability of the plasma column, which is due to the coupling of density and temperature disturbances, was calculated. Normal mode analysis resulted in an instability criterion for the m = 0 mode. (auth)

17230 RESISTIVE INSTABILITY IN A LOW-PRESSURE PLASMA. F. C. Hoh (Royal Inst. of Tech., Stockholm). p.409-11 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A general mode of the low-β plasma was derived by an exact treatment including the effects of heat conductivity and finite Lamor radius. A result of this analysis was the conclusion that a stellarator-type of discharge during ohmic heating is completely stabilized by heat conduction when the electron temperature exceeds some 30 ev. (M.C.G.)

17231 AFTERGLOW STUDIES OF TRANSIENT DISCHARGES. J. C. Craggs (Univ. of Liverpool). p.423-8 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Studies of afterglows are reviewed briefly. Dissociative recombination effects and electron-atomic ion recombination are discussed. High-current spark afterglows are described. (M.C.G.)

17232 ELECTRON ENERGY DECAY IN THE HELIUM AFTERGLOW. J. Charles Ingraham and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). p.429-32 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

A gated microwave radiometer was used to study the electron energy decay in the afterglow of a pulsed d-c discharge in helium. An analysis of the energy decay is presented for the pressure range from 0.06 to 1.00 mm Hg and for electron energies below lev. It is shown that in this regime the energy decay is controlled by cooling of the electrons through elastic recoil collisions with the helium atoms and heating of the electrons due mainly to ionizing collision of two helium metastable atoms for pressures above 0.5 mm or to collisions of the second kind (superelastic) between an electron and a helium metastable atom for pressures below 0.5 mm. (auth)

17233 RELAXATION RATE OF ELECTRONS TO EQUILIBRIUM. H. Fields and G. Bekefi (Massachusetts Inst. of Tech., Cambridge). p.433-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Measurements are presented of the time it takes for electrons to relax from an initially non-Maxwellian to a Maxwellian distribution of velocities. The experiments were made in the afterglow of a weakly ionized, pulsed d-c discharge subjected to a magnetic field. The time variation of the distribution function was inferred from time-resolved measurements of the microwave emission spectrum from the plasma. The experiments indicate that the distribution function f(v,t) relaxes more slowly than the relaxation due to electron-electron collisions and faster than that due to elastic recoil with atoms. In addition to these measurements the relaxation of the mean electron energy $\bar{U}$ was observed. This rate was found to be much faster than can be predicted from elastic electron-atom collisions. (auth)

17234 ANALYSIS OF AN AFTERGLOW PLASMA IN ARGON. T. L. Dutt, M. C. Cavenor, R. G. A. Knott (English Electric Co., Ltd., [Whetstone, Leics], Eng.). p.439-48 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

The dielectric constant of an argon afterglow plasma was investigated in the range 0.5 to 500 Mcps for argon pressures 4.6, 7.5, and 10 mm Hg. It was found that the detuning can be reproduced theoretically by assuming the plasma to be described by a complex dielectric constant,

$$\epsilon_c^{11} = 1 - \frac{\omega_p^2}{\omega}\left[\frac{\omega - \omega_0^2/\omega}{\nu^2 + (\omega - \omega_0^2/\omega)^2} + i\,\frac{\nu}{\nu^2 + (\omega - \omega_0^2/\omega)^2}\right],$$

derived from an equation of motion for the electron, which includes a term describing small elastic forces of constraint acting on the electron. ω_0 is the natural frequency of oscillation of the electron under the action of these short range forces; ω_p and ω are the plasma frequency and signal frequency respectively. The values obtained for ω_0 are such that the dielectric constant ϵ_c^{11}, suggested, yields a real part greater than +1 at signal frequencies less than $\omega \sim 10^8$.

When $\omega \gg \omega_0$, ϵ_c^{11} closely approaches in value to the dielectric constant normally used for a free electron gas. (auth)

17235 AFTERGLOW TAILS AND STABILITY OF HIGH-DENSITY NANOSECOND ARC CHANNELS. Heinz Fischer and Walter B. Rueppel (Air Force Cambridge Research Labs., Bedford, Mass.). p.451-5 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Afterglow tails of high-density nanosecond arc channels in 1 atmosphere air were analyzed to $<10^{-3}$ of peak value exceeding 500 nanosecond duration, applying a gated Kerr cell, which protects the photodetector from saturation. Photographic observation of afterglow channels was made possible by the exceptional stability of such plasma, which is demonstrated. Photoelectric and photographic decay functions agree. Spectral differences are observed and discussed. (auth)

17236 LUMINESCENT DISCHARGES UNDER PRESSURE AND COEFFICIENT OF RECOMBINATION. Yvonne Leycuras (Laboratoire des Hautes Pressions, Bellevue, France). p.457-9 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963. (In French)

The maximum amplitude of the relaxation oscillations was measured as a function of the frequency of discharge at different pressures. A relation was established for the coefficient of dissociative recombination. Results are presented for the case of helium. (M.C.G.)

17237 THE DOUBLE SHEATH AT A DISCHARGE CONSTRICTION. F. W. Crawford and I. L. Freeston (Univ. of Stanford, Calif.). p.461-4 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Studies of the thin double sheath at a constriction in a discharge column were made with a movable Langmuir probe. Application of the Druyvesten method allowed observations of the decay of the high-velocity group entering the smaller section to be made. An expression is given for the approximate volt-drop across the sheath and some comments are presented on the role of the sheath in exciting fluctuations in the tube. (auth)

17238 SPACE CHARGE ASPECTS OF R-F PLASMOIDS. A. Boschi and F. Magistrelli (Euratom-CNEN, Frascati, Italy). p.465-7 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

Space charge aspects of low-power plasmoids were studied in different gases, in the frequency range from 3 to 30 Mcps and pressure from 1×10^{-4} to 1×10^{-3} mm Hg. The energy spectrum of the positive ions reaching the wall was measured by means of an electrostatic cage. This spectrum shows the presence of ionization in the sheath. From it radial potential across the plasmoid was derived. (auth)

17239 MOTION OF IONS IN THE CATHODE SHEATH OF AN ARC. T. H. Lee and A. N. Greenwood (General Electric Co., Philadelphia). p.469-74 of "VI^e Conference Internationale sur les Phenomenes d'Ionisation dans les Gaz. Vol. I." Paris, SERMA, 1963.

It is shown that to account for the ion current in the cathode sheath, the diffusion of ions due to a very strong gradient must be considered. This gradient is set up to neutralize the space charge of electrons diffusing toward the cathode against the electric field. By treating the gas in the sheath as a multicomponent mixture in the presence of an electric field and a concentration gradient, an effective mobility can be defined for the ions, which includes the effect of concentration gradient. It is shown that the electric field required to calculate the ion current is quite reasonable. (auth)

17240 RESEARCH ON ION BEAM FORMATION FROM PLASMA SOURCES. W. O. Eckhardt, J. Hyman, Jr., G. Hagen, C. R. Buckey, and R. C. Knechtli (Hughes Research Labs., Malibu, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1964, Preprint 64-8, 8p, $1.00. (CONF-392-2)

From Aerospace Sciences Meeting, New York, Jan. 1964.

The conditions determining the position of the plasma boundary in a positive-ion extraction system are established quantitatively. The specific problems encountered with plasma-type ion sources are discussed. (R.E.U.)

17241 IMPROVEMENTS IN OR RELATING TO PLASMA ACCELERATORS. Siegfried Hansen (Litton Industries Inc.). British Patent 952,088. Mar. 11, 1964. Filed Oct. 6, 1960.

An electromagnetic accelerator is designed for accelerating an ionized gas plasma to extremely high velocities at high flow rates. In the accelerator, a moving, preferably accelerating, magnetic field accelerates a ring-shaped plasma mass from one end of a structure to the other end to produce outbursts. The structure and means for producing the moving magnetic field are described in detail. (D.L.C.)

17242 A UNIT FOR THE PRODUCTION OF HIGH-TEMPERATURE PLASMA. Emil Zizka. Czechoslovak Patent 100,179. July 15, 1961.

A patent was issued for a unit intended for the heating and holding of a high-temperature deuterium or tritium thermonuclear plasma. The unit consists of a cylindrical vacuum chamber, two reflector anodes at the butts, and a central ring-shaped cathode. The chambers are placed in a solenoid generating a longitudinal magnetic field. In the chamber a Penning type discharge is excited. (Referativnyy Zhurnal, Fizika, No. 9, 1962)

Shielding

17243 (GAMD-3690) NEUTRON AND GAMMA-RAY HEATING IN IRON SLABS. Arthur Reetz (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Oct. 24, 1962. Contract AF29(601)-2207. 60p. (AD-418403)

Radiation heating in iron slabs 2 to 8 inches thick was calculated for monoenergetic neutrons and gamma rays incident normal to the slab. Transmission, reflection, and absorption of the energy and the number of neutrons are presented for neutrons of energies from 1.9 ev to 14 Mev. The heat deposition and energy transmission are presented for gammas of 0.5 to 8 Mev. Monte Carlo techniques are used for the high-energy (>0.5 Mev) neutron calculations and the one-dimensional neutron transport code DSN is used for the low-energy neutron calculations. Monte Carlo techniques and gamma differential energy spectra are used in the gamma calculations. (auth)

17244 (NASA-SP-3008) ENERGY SPECTRA AND ANGULAR DISTRIBUTIONS OF ELECTRONS TRANSMITTED THROUGH SAPPHIRE (Al_2O_3) FOILS. Martin J. Berger and Stephen M. Seltzer (National Bureau of Standards, Washington, D. C.). 1964. Contract R-80. 108p.

Monte Carlo results are presented, in the form of 72 tables, pertaining to the transmission of electrons incident with energies of 1, 2, 2.954, 4, 5.907, and 8 Mev on sapphire foils with thicknesses of 0.1, 0.2, and 0.3 g/cm^2. Two

types of beam geometry are treated for all source energies: (a) perpendicular incidence; (b) beams with an initial cosine-law angular distribution (corresponding to an isotropic electron flux). For a source energy of 2 Mev, various incident beam obliquities are also treated, ranging from grazing to perpendicular incidence. The physical factors taken into account include the energy losses due to collisions with atomic electrons (mean value and fluctuations), the mean energy loss due to bremsstrahlung, and the angular deflections and path detours due to multiple Coulomb scattering by atoms. (auth)

17245 ABSORPTION OF γ-RAYS BY BURNT BRICKS. M. Muminov and Kh. Khaidarov. Tr. Samarkandsk. Gos. Univ., No. 117, 3-11(1962).

An experimental study was made on the attenuation of a wide and a narrow γ-ray beam passing through an absorber of complex composition (burnt brick). As a source of γ radiation a preparation of Co^{60} was used. Recording of the γ radiation was carried out with the aid of a Geiger-Müller counter and a B-type installation. The results of the measurements are presented in the form of a series of diagrams. (Referativnyy Zhurnal, Fizika, No. 1, 1963)

17246 VOPROSY DOZIMETRII I ZASHCHITY OT IZLUCHENII. VYPUSK 2. (Problems in Dosimetry and Radiation Protection. Issue 2). V. I. Ivanov, ed. Moscow, Gosatomizdat, 1963. 192p.

Problems in the dosimetry and shielding of γ rays, neutrons, electrons, and bremsstrahlung are considered. The Monte Carlo method for calculating the angular and energy distributions of a monodirected point source of γ rays, the intensity of γ rays scattered in various shielding materials, laboratory shielding for neutron sources, shielding for Van Allen electrons and bremsstrahlung, shielding for electron accelerators, self-absorption and self-scattering of β rays in gases, and neutron backscattering spectra are discussed. Methods for calculating the efficiency of various detection instruments such as ionization chambers, fast neutron spectrometers, and neutron scintillation detectors are also outlined. Twenty-five papers are included. (C.E.S.)

REACTOR TECHNOLOGY

General

17247 (APDA-158) STUDY OF EOCR MODIFICATIONS FOR TESTING FAST REACTOR FUELS. G. Ball, J. J. Edwards, L. R. Kovac, J. DeFelice, W. H. Jens, R. Poggi, and H. S. Warberg (Atomic Power Development Associates, Inc., Detroit). Feb. 17, 1964. Contract AT (11-1)-865. 69p.

A study was made of two methods for increasing the power generation in a fast reactor fuel element test sample (19-pin PuO_2-UO_2) in a fast test loop in the EOCR. The two methods, which involved hardening the EOCR spectrum and the use of a converter plate in place of a boron filter, did not result in any appreciable increase. However, an effective way of increasing the sample power is to increase the power density in the EOCR, and this way in combination with a cadmium or plutonium filter and fuel enrichment can increase the power from 0.22 to 1.8 kw/in. (D.L.C.)

17248 (BMI-X-278) MATHEMATICAL MODELS OF FISSION-PRODUCT DEPOSITION AND THE CORRELATION OF EXPERIMENTAL DATA. G. E. Raines (Battelle Memorial Inst., Columbus, Ohio). Mar. 17, 1964. Contract W-7405-eng-92. 31p.

Various models of fission-product deposition in gas-cooled reactor circuitry were explored to aid in correlating and understanding the experimental data from model loop experiments. In all cases, the operation was considered to be steady state. The first model, consisting of a simplified boundary-layer problem, considered that the boundary layer was completely destroyed at flow disturbances and allowed for adsorption of the fission-product species at the wall. Relatively simple analytical solutions were possible but only limited success in correlating the data was achieved. The second model consisted of a finite difference solution of the diffusion equation, allowing for flow and adsorption at the wall. Turbulent diffusivities were estimated and employed. Better, but still not adequate, correlation with experimental data was possible with this more complex model. (auth)

17249 (EIR-60) ÉTUDE DE LA PÉNÉTRATION DES NEUTRONS THERMIQUES DANS DES CANAUX CYLINDRIQUES VIDES TRAVERSANT UN MILIEU HYDROGÉNÉ. (Study of the Penetration of Thermal Neutrons in Empty Cylindrical Channels Through Hydrogenous Media). Akbar Etemad (Switzerland. Eidgenössisches Institut für Reaktorforschung, Würenlingen). Dec. 1963. 73p.

The thermal neutron flux in empty cylindrical channels surrounded by hydrogenous media was studied theoretically, concluding with the development of a method of calculation. This method is based on the hypothesis of an equilibrium between the fast and thermal flux and on the application of the theory of scattering in a scattering medium and the theory of transport to the interior of the channel. The results of the measurement of the axial distribution of the thermal flux at the interior of two channels of different dimensions, installed in the reservoir of the SAPHIR reactor and in front of its core, are reported. A comparison was established between these results and the values given by the calculation method proposed. The agreement is very satisfactory. The maximum deviation between the measured and calculated values is of the order of 22% for one of the channels and 14% for the other. Other results concerned the radial distribution of the thermal flux at the interior and exterior of the channels and the axial distributions of the intermediary and fast flux. (tr-auth).

17250 (PAN-O-117) MASZYNA MATEMATYCZNA DLA CEL'OW AUTOMATYKI REAKTOROWEJ. (Computer for Automatic Reactor Calculations). Wieslaw Filipczal (Polish Academy of Sciences. Inst. of Nuclear Research, Swierk). 1963. 93p.

17251 (EURAEC-931) SWIRL FLOWS IN BOILING WATER. USE OF TWISTED TAPES IN BOILING WATER REACTORS. Special Report No. 17. (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes, France). [nd]. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7-RDF. 40p. (A translation)

Reported is a first exploration of the performance of a boiling water reactor, the core of which consists of an isotropic rod array without assembly boxes. A comparison is made between a core with twisted tapes and without twisted tapes, assuming a 30% increase in critical heat flux with twisted tapes. The main parameters are obtained in the following way. Given the maximum power per unit rod length, inlet subcooling, core height, exit quality, overall heat flux peaking factor, and powrr shape, the coolant flow rate in an elementary channel is determined. For each inlet velocity, the limiting critical heat flux yields a minimum rod diameter. The elementary channel equivalent diameter can be deduced. Corresponding to each case–without twisted tapes (type I), and with twisted tapes (type II)–two series of coupled rod diameter–rod pitch are obtained for different inlet velocities (0.5–3 m/sec). With a constant 2.72% enrichment, the k_∞ corresponding to each geometry has been computed. The geometry leading to the maximum k_∞ has been selected. The following table gives the corresponding values and shows the significant increase in specific power with Zircaloy twisted tapes:

	k_∞	rod radius (cm)	rod pitch (cm)	power per unit fuel mass kw/kg/UO_2	power per unit core volume
Type I	1.394	0.626	2.51	12.4	25.9
Type II	1.361	0.464	1.93	22.5	42.8

(auth)

17252 ONE-GROUP COLLISION-PROBABILITY CALCULATIONS FOR ANNULAR SYSTEMS BY THE METHOD OF BONALUMI. A. Jonsson (Atomic Energy Establishment, Winfrith, Dorchester, Eng.). J. Nucl. Energy, Pt. A & B, 17: 511-18(Dec. 1963).

An approximate method given by Bonalumi is used to calculate the collision probabilities in a cylindrical cell with the fuel in the form of concentric annuli of arbitrary cross sections; these are used to derive one-group flux distributions across the cell. Comparisons are given with exact collision-probability calculations and with Carlson Sn calculations. It is concluded that the method gives results of acceptable accuracy in normal fine-structure problems. Programmed for the Ferranti Mercury computer, the method is faster than existing transport theory codes and is well suited to routine calculations, for example as a subroutine in a thermalization code. (auth)

17253 FRICTION FACTORS FOR ISOTHERMAL TURBULENT FLOW THROUGH SEVERAL REACTOR FUEL ELEMENT GEOMETRIES. J. H. Brindley and D. A. Huber (Atomics International, Canoga Park, Calif.). J. Nucl. Energy, Pt. A & B, 17: 571-2(Dec. 1963).

Hydraulic tests were performed in a 4-in. water loop on bundles of finned and smooth fuel pins spaced on a triangular lattice inside a hexagonal duct. Friction factor data were obtained for Reynolds numbers of 2,000 to 50,000. It is shown that the conventional hydraulic diameter D_e is a good approximate correlation parameter for the prediction of pressure drops across the particular fuel configurations. (R.E.U.)

17254 PROGRESS IN THERMIONIC CONVERSION. J. W. Gardner (English Electric Co. Ltd.). Nucl. Energy, 68-72(Mar. 1964).

A review is presented on developments in thermionic conversion. In particular, overcoming space-charge and work functions is discussed. Nuclear applications such as ionization in reactors are also discussed. (P.C.H.)

17255 YADERNO-FIZICHESKIE KONSTANTY. SPRAVOCHNIK. (Constants in Nuclear Physics. Handbook). I. V. Gordeev, D. A. Kardashev, and A. V. Malyshev. Moscow, Gosatomizdat, 1963. 508p.

The handbook includes graphs of total cross sections and angular distribution of elastic and inelastic scattering for intermediate and fast neutrons. Data on fission product energy and yield, nuclear temperatures, and cross sections for (n,2n), (n,α), and (n,f) reactions are expanded, and additional information on atomic, thermophysical, and diffusion constants are included. Prices for reactor materials are also given. Problems related to γ attenuation and neutron thermalization are discussed. Reaction cross sections, α magnitudes, and level densities calculated from data available at the end of 1962 are given. All experimental data are grouped according to neutron energies and nuclear mass numbers. The handbook is geared for engineer designing and operating nuclear reactors. (R.V.J.)

17256 BOUNDARY CONDITIONS IN GAP GEOMETRY. W. Rothenstein and J. Helholtz (Israel Inst. of Tech., Haifa). 7p. (CONF-187-83)

From American Nuclear Society Meeting, New York, Nov. 1963.

The procedure for calculating the monoenergetic angular flux density in lattice cells including voids between fuel and moderator is discussed. Boundary conditions describing straight-line-flight of neutrons across the gap are discussed. (R.E.U.)

17257 CONSERVATION OF THERMAL ENERGY. Andrew D. Suttle, Jr. and Hermann E. von Rosenberg (to Esso Research and Engineering Co.). U. S. Patent 3,126,322. Mar. 24, 1964. Filed July 14, 1960.

The thermal energy of a nuclear reactor may be conserved by using as the reactor coolant a hydrocarbon fraction boiling within the range 220 to 650°C (preferably 340 to 550°C) and containing not more than 5% of extraneous materials having neutron cross sections of >10 barns. The hot coolant may either be cracked outside of the reactor or used to heat another petroleum hydrocarbon which is to be converted. (D.L.C.)

Auxiliaries and Components

17258 (BRL-Memo-1530) THE PLASTIC RESPONSE TO INTERNAL BLAST LOADING OF MODELS OF OUTER CONTAINMENT STRUCTURES FOR NUCLEAR REACTORS. John W. Hanna and William O. Ewing, Jr. (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Jan. 1964. 30p.

Presented are results of an experimental investigation of the plastic response of two geometrically scaled models of nuclear reactor outer containment vessels to internal blast loading. Tests were performed to study the ability of the containment shells to maintain integrity when subjected to large amounts of explosively released energy when unsupported (suspended in air), when half-buried in the ground, and when half-imbedded in concrete. The results show that the vessels tested will withstand a relatively large amount of explosively released energy, as compared to the "maximum credible incident" expected, provided that the welds are adequate and that access or other openings are properly reinforced. (auth)

17259 (NP-13659) RASCHET EFFEKTIVNOSTI SISTEMY POGLOSHCHAYUSHCHIKH STERZHNEI. (Calculation of the Efficiency of a System of Absorber-Type Rods). V. V. Orlov and L. Ya Isakova (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoĭ Energii). 1963. 35p.

A method is suggested for calculating rod worths and flux distributions in a reactor. In contrast to A. D. Galanin (Theory of Thermal Neutron Nuclear Reactors) the solution was found by reducing proper functions of an unperturbed reactor to consequent functions. The method results in a sum of terms from considerations of two-, three-, ... -rod interactions. A solution was derived for arbitrary rod positions along a reactor radius or height. Methods for averaging effective boundary conditions in a one-group reactor model are also discussed. (tr-auth)

17260 (ORNL-3546(Suppl.1)) PRESTRESSING A TWO-LAYER PRESSURE VESSEL BY CONTROLLED YIELDING OF THE INNER LAYER. R. W. Schneider (Oak Ridge National Lab., Tenn.). Apr. 1964. Contract W-7405-eng-26. 44p.

A method of designing a two-layer pressure vessel is presented wherein contact between the layers is produced by controlled yielding of the inner vessel by internal pressure. The amount of prestress depends upon the dimensions of the vessel, the properties of the material of construction, and the prestressing pressure. The method takes into account the actual stress-strain curve of the material and satisfies the rules of plastic flow with work hardening. (auth)

17261 (ZFK-RN-8) EIN MEGAWATTSTUNDEN-ZÄHLER ZUR REGISTRIERUNG DER VOM REAKTOR ABGEGEBENEN WÄRMEENERGIE. (A Megawatt-hour Meter for Registering the Reactor Heat Energy). S. Menzel and A. Oehmigen (Germany. Zentralinstitut für Kernphysik, Dresden). May 1960. 12p.

In order to study the relation between energy given off by the reactor and burnup of the fuel, a megawatt-hour meter for registering the reactor heat energy was developed. Operation of the meter is described. (M.C.G.)

17262 SOME ASPECTS OF STRUCTURAL PROBLEMS IN REACTOR ENGINEERING. N. W. Murray (Monash Univ., Victoria, Australia). At. Energy Australia, 7: 6-14 (Jan. 1964).

Some problems associated with the structure of the primary gas circuit of a reactor vessel are discussed, including primary gas ducts, heat exchanger, and charge machine. (R.E.U.)

17263 EQUATIONS OF SERVOSYSTEMS WITH MOVING DETECTORS FOR CONTROL OF NUCLEAR REAC-

TORS. P. Kovanitz. Avtomat. i Telmekhan, 24: 1660-71 (1963). (In Russian)

Equations of servosystems with moving detectors are proposed for measuring and automatic control of nuclear reactor power and period. (auth)

17264 CONTROLLED HUMIDITY TECHNIQUE IN CLEAN CONDITIONING OF NUCLEAR REACTOR PRESSURE VESSEL. Heating Ventilating Rev., 3: 1(June 1963).

The necessary steps in clean-conditioning of the interior of a pressure vessel at the Dungeness Nuclear Power Station are described with emphasis on the reduction of oxidation of the vessel material. (R.E.U.)

17265 AN ASSAYING SYSTEM FOR HTGR FUEL COMPACTS. Kenneth A. Zimmermann (General Atomic Div., General Dynamics Corp., San Diego, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 319-22(Jan. 1964).

An automatic gamma scanning apparatus to determine U-235 content in fuel compacts is described. Two automatic scanners, controlled by a logic unit, drive each compact past a NaI(Tl) scintillation detector. Pulse-height selection permits counting only the emitted 184-kev gamma rays. After each scan, a scaler containing the total count is gated off and a readout cycle initiated. Comparison logic analyzes the count in terms of 4 values set into the system by selector switches. The interrogation circuits then decide the percentage of fuel loading relative to a standard element and indicate this to the operator. Simultaneously, the scaler count is printed on paper tape. Possible errors are considered and these are correlated with test results. (auth)

17266 THE EFFECT OF MODERATOR SCATTERING LAW ON THE PHYSICS OF GRAPHITE-MODERATED THERMAL REACTORS. J. D. Macdougall (Atomic Energy Establishment, Winfrith, Dorchester, Eng.). J. Nucl. Energy, Pt. A & B, 17: 481-90(Dec. 1963). (AEEW-R-248)

The effect of crystal binding in graphite on reactor physics quantities such as reactivity and temperature coefficient is investigated for graphite-moderated thermal reactors using various models of graphite. The effect is found to be just significant for reactor physics purposes. (auth)

17267 TRANSIENT BEHAVIOR STUDY OF COOLANT AND CIRCULATING PUMPS IN PRESSURIZED WATER REACTORS WHEN THE PUMPS ARE BREAKING DOWN. H. Rosenkranz (VEB Atomkraftwerk, Betriebsteil Berlin, Berlin). Kernenergie, 7: 88-95(Feb. 1964). (In German)

Differential equations were derived, which describe the condition of circulating pump breakdown. The general equation for the coolant was set up first for the case of complete interruption of supply which occurs when all pumps break down together. Next, the conditions were examined when one or two pumps break down, simultaneously or not. Two possibilities were considered: either the speed of the pump decreases slower than that of the coolant, or the other way around. Thus, the transient period is divided into three intervals: from the instant of pump breakdown till either the pump or the coolant reaches zero speed, from that moment on till the other of the two reaches zero speed, and then till the valve is fully closed. The numerical solution of the differential equations was obtained with a digital computer and then evaluated for design purposes. (OTS)

17268 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Roland Roche (to Commissariat a l'Energie Atomique). British Patent 951,227. Mar. 4, 1964. Priority date Sept. 6, 1960, France.

A containment and circulation system for a liquid reactor moderator is described. The container has internally at its top a pressurized bell immersed in the moderator to maintain the moderator level during operation and also to "wet" the entire inner surface of the container. Individual bells are also provided for each pressure tube within the container. (R.E.U.)

17269 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR PLANT. Alan Alfred Cooper (to Societé Anglo-Belge Vulcain). British Patent 951,896. Mar. 11, 1964. Filed Feb. 7, 1962.

A reactor plant employing a pressurized coolant-moderator of a heavy water–light water mixture and operated according to the spectral shift control principle, is designed with means for easy priming of the coolant flow circuit. The means comprise a connection between the highest point of the pressure vessel and a closed pressurizer compartment containing helium. In priming the circuit, coolant is pumped into the pressure vessel to a low level, air is removed from the pressure vessel and circuit piping, and the pressure vessel is then filled with helium. Coolant is then pumped into the circuit until it is primed, and the reactor is started. At full operating temperature, the coolant is expanded to fill the rest of the pressure vessel, and the helium above the coolant is compressed to the required circuit pressure. The reactor may be shut down by reducing the power output; the helium expands to maintain the continuity of the coolant through the whole flow circuit. At any shutdown stage, a return to full reactor power can be effected without repriming. (D.L.C.)

17270 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Walter Forrester Stanners (to General Electric Co.). British Patent 952,011. Mar. 11, 1964. Filed Mar. 13, 1962.

An optimum power rating distribution is one which is asymmetrical in the direction of coolant flow and generally decreasing in this direction. Such a power distribution may be obtained in a graphite-moderated gas-cooled reactor by disposing neutron-absorbing members, e.g. iron rods, in the core. (D.L.C.)

17271 PROCESS FOR LOADING AND UNLOADING A NUCLEAR REACTOR. Pierre Dequenes (to Electricite de France (Service National)). British Patent 952,558. Mar. 18, 1964. Priority date Sept. 6, 1961, France.

A method for loading and unloading a gas-cooled graphite-moderated reactor that avoids, as much as possible, idle movements of the handling device and limits the path of travel of the "half-used" fuel elements from the channel to their place of temporary storage is described. In addition to providing at least one storage station for the half-used fuel elements and, where appropriate, closure and reflector blocks, two neighboring channels served by the same standpipe are associated in a single handling cycle so that the unloading of the used fuel elements from one channel and the loading of new fuel elements into the other channel is effected by a to and fro movement of the handling device. (M.C.G.)

17272 DEVICES FOR ANCHORING AND EXTRACTING PLUGS IN AND FROM FUEL CHANNEL OF NUCLEAR REACTORS. Roland Roche, Jean-Marc Hässig, and Pierre Cousseran (to Commissariat à l'Énergie Atomique). U. S. Patent 3,125,123. Mar. 17, 1964. Filed Aug. 10, 1962.

An anchoring and extracting device for a plug in a reactor channel is designed to meet various safety requirements while being capable of effecting a great number of

channel opening and closing movements without failure. The device includes a plurality of pawls pivoted on the plug and adapted to lock the plug to the channel and means for locking and unlocking the pawls. (D.L.C.)

17273 HEAT INSULATION DEVICES. Everett Long (to United Kingdom Atomic Energy Authority). U. S. Patent 3,125,160. Mar. 17, 1964. Priority date June 24, 1957, Great Britain.

Heat insulation devices are designed for members (diaphragm and pipes) separating hot and cool sodium coolant in a sodium-graphite reactor employing re-entrant cooling. The devices comprise layers of tiles spaced from one another at their edges to accommodate for thermal expansion, the tiles in any layer overlapping tiles in adjacent layers. In one particular embodiment, the spaces between the pipes passing through the diaphragm are covered with alternate layers of hexagonal and diamond-shaped steel dies, and the pipe junctions with the diaphragm are fitted with concentric insulating sleeves. (D.L.C.)

17274 NUCLEAR REACTORS. Philip Cloudesley Warner (to United Kingdom Atomic Energy Authority). U. S. Patent 3,126,033. Mar. 24, 1964. Priority date July 31, 1959, Great Britain.

A removable restrictor for controlling coolant flow in a vertical channel of a gas-cooled power reactor, is designed which will remain in position without locking devices. The restrictor comprises a fixed location member in the channel and a removable gag member adapted to be forced against the location member by the combination of downward resultant forces. The location and gag members are provided with cooperating seats arranged to form a cavity between the members, and the gag member has a passage connecting the cavity to the coolant channel to equalize the pressures in the cavity and in the downstream channel. (D.L.C.)

Crititicality Studies

17275 (AEEW-R-183) METHODS OF CALCULATING FOR HETEROGENEOUS FAST REACTORS WITH A PLANE PERIODIC CORE STRUCTURE. M. F. James (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England). June 1962. 29p.

Some preliminary calculations of reactivity and neutron distribution in a fast reactor with a heterogeneous core of periodic structure are described. A method of allowing for the finite size of the core in cell calculations is discussed. By considering a particular unreflected core of very simple geometry, cell calculations using this method were compared with calculations on the actual finite core. The agreement in the calculated k_{eff} and neutron distribution was found to be satisfactory. Different approximate methods for solving the multigroup transport equations for a cell in plane geometry are also discussed. (auth)

17276 (EUR-498.e) THE CRITICAL FACILITY KRITO. J. G. Ackers, M. Bustraan, J. Coehoorn, R. J. Heyboer, F. Luidinga, M. Muysken, W. W. Nijs, A. Tas, and W. L. Zijp (Reactor Centrum Nederland, Petten). 1964. 33p. (CONF-133-40)

From International Atomic Energy Agency Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963.

The first experimental program is part of a joint undertaking of Reactor Centrum Nederland and Euratom for the development of a nuclear reactor for ship propulsion, known as the NERO project. Thus the primary objective is the measurement of reactor physics parameters of the designed NERO core. This design foresees in a power reactor of PWR type, with a two zone core of UO_2 fuel, canned in Zircaloy with enrichments of 3.1% and 3.8% and 12 uniformly distributed control rods of a cadmium-silver-indium alloy. However, for economical reasons, in KRITO use is made of aluminium as canning material and B_4C as poison material and the experiments will be done with a constant moderator to fuel ratio. A short description of the facility and the experimental program is given. First criticality was attained on March 29, 1963. The results obtained up till September 1963 are summarized. (auth)

17277 (EUR-499.e) THE SUBCRITICAL FACILITY PUK. M. Bustraan and A. Tas (Reactor Centrum Nederland, Petten). 1964. 22p. (CONF-133-39)

From International Atomic Energy Agency Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963.

A short description is given of the subcritical facility PUK, which has been designed as a complement to the critical facility KRITO. The KRITO project is a part of a joint undertaking of Euratom and RCN for the development of a nuclear reactor of the PWR type for ship propulsion, known as the NERO project. The facility will consist of a clean hexagonal lattice of 3.8% enriched UO_2 fuel rods canned in aluminum tubes with an outer diameter 12 mm and inner diameter 10 mm, with a lattice spacing of 15.1 mm, giving a H_2O/UO_2 volume ratio of 1.07. The effective multiplication factor will be lower than 0.95. It will be possible to split the core into two halves separated by a vertical water gap, the size of which may be varied from 2 mm to 38 mm. The facility will be placed against the outer reflector of the Argonaut type reactor, L. F. R., at the reactor center at Petten. To obtain a cylindrical symmetric neutron flux the core will be rotated around its vertical axis. The facility will be used to measure intracell flux distributions and lattice parameters, to measure the effects of power distribution of water gaps in a lattice and to study methods for preventing flux peaking, and to supply general experimental data for checking calculational techniques. Techniques for measurements of intracell flux distributions in tightly packed lattices and of power distributions near water gaps are described. Attention is given to the calculation of spatial dependent thermal neutron spectra by a modified THERMØS program and to the calculation of power distributions near water gaps. (auth)

17278 (KAPL-M-6101) FISSION RATE ACTIVATION STUDIES IN THE THERMAL TEST REACTOR (TTR). W. W. Willis (Knolls Atomic Power Lab., Schenectady, N. Y.). Feb. 1964. Contract W-31-109-eng-52. 8p.

The relative merits of a U–Zr alloy and of chemically pure Ni and Zr for use as fission rate detectors in power reactors were investigated. The three materials were activated in hard and soft spectra, and their activities and decay characteristics were measured by standard techniques. It was concluded that the U–Zr alloy most adequately measures the local fission rate activity. (auth)

17279 (KAPL-M-JDJ-1) COMPILATION OF STANDARD CORES. VOLUME I. J. D. Jenkins (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 1963. Contract W-31-109-eng-52. 152p.

Core and cell models that are useful in the investigation of physics effects and the effectiveness of analytical methods are described. Some of the models are based on Knolls experimental assemblies; the Solid Homogeneous Assembly, the Plastic Moderated Assembly, the Pressurized Test

Reactor, and the L-7 Lattices. The remainder are hypothetical models that have proved useful in the investigation of specific physics effects. The models are described in detail, and the results of experiments and calculations on these models are presented. In addition, a summary of frequently used nuclear codes and a brief description of calculational methods employed at Knolls are given. (auth)

17280 (WCAP-6059) TURBO*—A TWO DIMENSIONAL FEW-GROUP DEPLETION CODE FOR THE IBM-7090. S. M. Hendley and R. A. Mangan (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Mar. 1964. Contract AT(30-1)-3017. 134p.

The program TURBO*, based on TURBO, solves the few group, two-dimensional (xy geometry) neutron diffusion equations in combination with a pointwise burnup calculation for the determination of reactivity-lifetime relationships. TURBO* contains a calculation of the effect of power density on resonance capture in uranium-238. The number of lethargy groups is restricted to 2 or 4, and the number of points of solution is limited to 7500. (auth)

17281 (ZFK-TPH-5) THEORETISCHE UNTERSUCHUNGEN ZUM NULLREAKTOR. (Theoretical Study on Zero Reactor). Hans Ulrich Barz (Germany. Zentralinstitut für Kernphysik, Dresden). Aug. 1961. 27p.

In a study of the dependence of the critical data of zero reactors on the ratio of water to fuel, it was found that the dependence is practically important only for the total amount of fuel in the reactor and less for V_w/V_f. The provided value for V_w/V_f of 2.6 was found to lie in the most favorable range. A cadmium area of 441 or 9336 cm^2 between the active zone and outer reflector gave a compensation of 1 or 2% reactivity. The reactivity loss by discharge of the reflector water amounted to 0.0554. The thermal flux in the zero reactor for a cylindrically symmetrical arrangement with and without homogeneously distributed control rods on the border of the outer reflector and active zone was calculated. A flux of 12.5 neutrons/cm^2 sec was determined at the provided detector point. An investigation of the time relation showed that in the automatic shutdown time of 2 sec the power peak remains below 1.8 kw. The control rod velocity can therefore be chosen practically at random. If the reactor is not shut down the power peak lies in the range of 1.6 to 1.72 Mw. The power peak can not be depressed by changes in control rod velocity in reasonable bounds. (tr-auth)

17282 (CEA-tr-X-319) LE FACTEUR DE MULTIPLICATION RAPIDE EN SYMÉTRIE CYLINDRIQUE. (Fast Multiplication Factor in Cylindrical Symmetry). L. Orsoni and C. Tamaguini (Centro Informazioni Studi Esperienze, Milan). Translated into French from report CISE-35. [1952]. 26p.

The fast multiplication factor in cylindrical symmetry is derived, and the variation of this factor as a function of a is graphically represented. (J.S.R.)

17283 KINETICS OF A REACTOR LEAVING THE SUBCRITICAL STATE. T. S. Dideikin. Inzh. Fiz. Zh., Akad. Nauk Belorussk. SSR, 6: No. 11, 90-6(Nov. 1963). (In Russian)

Periodic change in neutron density, when the reactor is in the subcritical initial state, is caused by sinusoidal change of the effective multiplication factor with a definite amplitude and frequency. The mean value of neutron density, depending on amplitude, frequency, and initial depth, either remains constant, rises to a definite value, or increases infinitely with the velocity, depending on the frequency and amplitude of the sinusoidal change of the effective multiplication factor. Analysis of the behavior of neutron density at different laws of the effective multiplication factor change shows that the sinusoidal change combined with a simultaneous increase of the effective multiplication factor allows the reactor in subcritical state with an arbitrary depth of subcriticality to be brought up to the required level of neutron density; in this case the reactor is in subcritical state with respect to a non-periodic component of reactivity. (auth)

17284 EXPERIMENTAL DETERMINATION OF THE RATIO β^{eff}/l ON THE ZR-1 CRITICAL ASSEMBLY. L. Pál, L. Turi, and J. Vigassy (Central Research Inst. of Physics, Budapest). J. Nucl. Energy, Pt. A & B, 17: 473-80(Dec. 1963).

The parameter β^{eff}/l ($l = \tau/k$) was experimentally determined on the light-water moderated, enriched-uranium fueled, heterogeneous critical assembly ZR-1 using both the Feynman and the Rossi methods. It was found that the Rossi method can be used in the case of thermal reactors with hydrogenous moderator and enriched fuel provided the average neutron lifetime is not larger than 10^{-4} sec. The latter of the two methods proved to be faster and more reliable and even the effect of the delayed neutrons does not disturb the evaluation of the data measured. (auth)

17285 UNCONTROLLED POWER RISE IN A HETEROGENEOUS NUCLEAR REACTOR AFTER A SUDDEN CHANGE IN THE REACTIVITY. Edward Kostowski. Zeszyty Nauk. Politech. Slask., Energet., No. 58, 89-105(1962).

A theoretical analysis is reported of the change in the thermal power and neutron flux following a sudden change in the reactivity. The unequal rise in the fuel and moderator (coolant) temperature is taken into account. Formulas are derived for the reactivity vapor factor. This analysis can be used to determine safe reactivity and the power level that is reached after a sudden increase in the reactivity. The theoretical results were used to estimate the uncontrolled power change for the experimental reactor Helena. It was found that the formulas reported are suitable for safe reactivity calculations. (OTS)

17286 REACTOR PHYSICS INVESTIGATIONS CARRIED OUT WITH THE 3-Mw VVR-S REACTOR AND THE RUICO-1 SUBCRITICAL ASSEMBLY OF THE R.P.R. INSTITUTE OF ATOMIC PHYSICS. I. I. Purica (Inst. of Atomic Physics, Bucharest). 24p. (CONF-426-2). (In French)

From IAEA Study Group Meeting on Research Reactor Utilization, Athens, Sept. 1963.

The program (1957-1963) of experimental and theoretical research on reactor physics is summarized. Experimental equipment and procedures are briefly described, and some results are given. (D.C.W.)

Design and Feasibility

17287 (NP-13666) GRUPPOVYE KONSTANTY BYSTRYKH I PROMEZHUTOCHNYKH NEITRONOV DLYA RASCHETA YADERNYKH REAKTOROV. (Group Constants of Fast and Intermediate Neutrons for the Designing of Nuclear Reactors). L. P. Abagyan, N. O. Bozazyants, I. I. Bondarenko, and M. N. Nikolaev (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1962. 243p.

Multigroup constants for fast and intermediate neutrons are compiled, and new data on neutron interactions with nuclei are included. The principle of utilizing multigroup constants, selection of energy groups, averaging of macroscopic cross sections, averaging effective cross sections,

considerations of resonance effects, and determination of moderator cross section are discussed. A review is given on fission cross sections mean numbers of secondary neutrons, spectra of fission neutrons, capture cross sections and elastic and inelastic scattering. Tables of group constants and fission spectra for reactor materials are included. 578 references. (R.V.J.)

17288 SOME MATHEMATICAL PROBLEMS OF THE THEORY OF FAST REACTORS. Ivo Marek (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Apl. Mat., 8: 442-70(1963).

The existence of solutions to the system of neutron transport equations in multi-group energy approximation is shown. Fast reactors are considered because the diffusion approximation theory can be applied for thermal reactors. The existence of an eigenvalue with a maximum modulus and positive eigenvectors of the homogeneous system of kinetic equations is proved. The immediate result of the existence of these eigenelements is the convergence of iteration processes of the source-iteration type. Data are presented on the critical parameters and their unambiguity. (OTS)

Fuels

Refer also to abstracts 15960, 16426 and 16468.

17289 (CEA-Bib-41) LES COMBUSTIBLES NUCLEAIRES DISPERSES A PHASE FISSILE NON METALLIQUE. (Dispersed Nuclear Fuels with a Non-Metallic Fissile Phase). O. Bethoux (France. Commissariat a l'Énergie Atomique. Centre d'Etudes Nucléaires, Grenoble). 1963. 42p.

The definition, advantages, theory, and behavior under irradiation of this type of fuel are given. The dispersed systems containing a nonmetallic fissile phase, whose study and use have been much developed, are reviewed. (auth)

17290 (AEC-tr-6359) THE FUEL FOR RAPSODIE. Report of Test No. 253. (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucléaires, Fontenay-aux-Roses). Translated for Atomic Power Development Associates, Inc., Detroit, from a CEA report. [nd]. 47p.

The properties of various fuel elements for use in Rapsodie were evaluated. Physical and thermal properties, radiation stability, and burnup of UC–PuC, PuO_2–UO_2, and Pu–Mo–U were studied. Cladding was also investigated. The results are discussed. (P.C.H.)

17291 X-RAY MICROSCOPY APPLIED TO THE EXAMINATION OF COATED NUCLEAR FUEL PARTICLES. R. S. Sharpe (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Energy, Pt. A & B, 17: 505-10(Dec. 1963).

A technique for examining coated fuel particles by projection x-ray microscopy was developed. Experimental conditions suitable for carbon and silicon carbide coatings are outlined and the radiographic characteristics analyzed. The structural information that can be obtained by this method of inspection prior to irradiation is illustrated by typical results on experimental batches of fuel particles. The technique especially lends itself to the nondestructive measurement of coating thickness. For this application, the necessary corrections that need to be applied in order to obtain accurate data were derived. The method can be extended to the examination of irradiated fuel particles without introducing the autoradiographic blackening that is associated with the alternative technique of contact microradiography. (auth)

17292 INELASTIC DEFLEXION OF FUEL PLATES DUE TO COOLANT FLOW AND COMPRESSIVE EDGE LOADS. D. S. Griffin (Westinghouse Electric Corp., Pittsburgh). J. Nucl. Energy, Pt. A & B, 17: 551-7(Dec. 1963). (WAPD-T-1597)

A fuel plate in a long parallel-plate assembly may be subjected to biaxial compressive forces in the plane of the plate, as well as to a deflection-dependent transverse pressure induced by coolant flow. The resulting plate deflections can be sufficiently large to cause thermal failure of the assembly. An approximate method, based on inelastic plate theory, is used to predict plate deflections and to derive interaction equations for the combined system of loads causing a maximum allowable deflection. (auth)

17293 NUCLEAR FUEL ELEMENT AND PROCESS OF MAKING THE SAME. (to Carborundum Co.). British Patent 952,090. Mar. 11, 1964. Priority date Nov. 30, 1959, United States.

A solid reactor fuel element is described which has superior ability to retain fission products, is highly resistant to erosion and corrosion, and is particularly suitable for use in a pebble-bed type reactor. The fuel element comprises a core of fuel material and moderator material, and a coating of a refractory carbide, preferably silicon carbide. The element is spherical, although other shapes may be used, and refractory materials such as SiC, ZrC, etc. may be added to the core to improve the thermal expansion properties. Various examples of the fabrication of such fuel elements are given. (D.L.C.)

17294 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 952,977. Mar. 18, 1964. Priority date Nov. 15, 1961, United States.

A ceramic fuel element for a nuclear reactor is described. It consists of a plurality of stacked hollow ceramic moderator blocks, the inner surfaces of which define a cavity. A spine consisting of a plurality of stacked ceramic moderator pieces is centrally disposed within the stack of blocks and spaced inwardly from the inner surfaces of the blocks, so that an annular space is defined by the pieces and blocks. A plurality of ceramic fuel rods are spaced apart within this annular space. A means adjacent to the bottom of the fuel element is adapted to support it in a vertical position within a reactor core. (M.C.G.)

17295 FUEL ELEMENT FOR A NUCLEAR REACTOR AND METHOD OF MANUFACTURE. Mead D'Amore (to Westinghouse Electric Corp.). U. S. Patent 3,125,493. Mar. 17, 1964. Filed Sept. 29, 1960.

A reactor fuel element utilizing fuel pellets is designed with means for supporting the fuel elements within the cladding so as to avoid thermal jamming of the pellets. The means comprises a plurality of spaced discs with grooves along their sides, into which the cladding can be crimped to hold the discs in place, and with holes for equalizing fission gas pressures. Thus, the spaced discs divide the fuel element into compartments, each with several fuel pellets. The probability of thermal jamming of one of the pellets in any one compartment is small, and even if such a jamming does occur, the number of pellets affected by such a jamming is so few that the fuel element is not damaged. (D.L.C.)

Power and Power-Breeder Reactors

17296 (EURAEC-910) STATISTICAL METHODS FOR HOT CHANNEL AND HOT SPOT CALCULATION. Final Report No. 1, October 30, 1963. (FIAT. Sezione Energia Nucleare, Turin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 035-60-11-RDI. 63p. (FN-E-39)

The Monte Carlo program, STATOR, developed for the statistical calculation of the thermal-hydraulic correction factors of an ORGEL core is described, and a numerical analysis of an ORGEL core with the program is summarized. A steady-state analysis of the nominal core was performed first, and the correction factors of the central channel under prescribed tolerances were calculated. The effects of each single statistical independent parameter of the number of axial intervals (spots), and of the power level in the ORGEL coolant channel were also analyzed, together with the variation of the mean value and standard deviation of the two more important statistical independent parameters. A preliminary analysis of the statistical variation of the coolant outlet temperature when the inlet value is fixed in the nominal position was also performed, as well as an analysis of the additivity of the effects of independent parameters. (D.C.W.)

17297 (GEAP-4388) DEVELOPMENT OF PULSED NEUTRON APPLICATION TO POWER REACTOR START-UP PROCEDURES. Quarterly Progress Report No. 6, July 1–September 30, 1963. E. Garelis and P. Meyer (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Oct. 15, 1963. Contract AT(04-3)-189. 13p.

A technique is being developed to use pulsed neutron generators to measure the start-up procedures and shutdown margin of large, thermal power reactors. In the Humboldt Bay Power Reactor, operating difficulties with the pulsed neutron source developed. High voltage breakdowns in the magnetic field coil caused perturbations in the plasma and reduced the neutron yield. The alpha value of the full-shutdown configuration gives a realistic value for k_{eff}, when used with previously determined ($k\beta/l$). A value of k_{eff} of 0.944 was calculated. This figure is 2.5% higher than that of the cold core configuration and reflects the removal of the peripheral rods and fuel rearrangement. (N.W.R.)

17298 (HW-80092) PRCF EXPERIMENTS WITH H_2O MODERATOR. L. C. Schmid and L. D. Williams (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 30, 1963. Contract [AT(45-1)-1350]. 15p.

Some criticality and neutron physics experiments to be performed in the light water moderated Plutonium Recycle Critical Facility are described. The hazards and restrictions associated with the experiments are also discussed. (D.C.W.)

17299 (MND-M-1915) HANDLING AND TRANSPORTATION TESTS [OF] PM-1 TEST PACKAGE. W. H. Lambert, C. W. Blechschmidt, R. Dugas, and Charles L. Riggin (Martin Co. Nuclear Div., Baltimore). June 1960. Contract AT(30-1)-2345. 166p.

A description is given of the static and dynamic structural tests performed on the PM-1 nuclear power plant test package and associated equipment. Tests were conducted in the period from January to May 1960. (auth)

17300 (NAA-SR-9265) HALLAM NUCLEAR POWER FACILITY— REACTOR OPERATIONS ANALYSIS PROGRAM SEMIANNUAL PROGRESS REPORT NO. 2, MARCH 1, 1963–AUGUST 31, 1963. D. K. Darley, O. G. Jenkins, C. L. Larson, P. H. McCann, R. M. Mills, R. R. Stiens, and R. J. Walters (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Mar. 1, 1964. Contract AT-11-1-GEN-8. 162p.

The plant operation from initial criticality to date is reviewed, and miscellaneous plant and systems performance is discussed. On the nuclear analysis side, fuel element exposure and reactivity history calculations were carried out. Systems and components analysis is also discussed. (D.L.C.)

17301 (NP-13499) GAMMA II'S DYNAMISKE FORHOLD. (The Dynamical Behavior of GAMMA II). (Danish Assn. for Industrial Development of Atomic Energy, Hellerup). Nov. 1963. 128p.

The dynamic behavior of the GAMMA II reactor is calculated. The equations are derived for the reactor kinetics, start-up, thermodynamics of the reactor system, and the turbine system. The analog computations are given, and the results of the calculations are reported for reactivity and output variations, pressure changes, and turbine shut-down. The transfer functions were also determined. (J.S.R.)

17302 (UCRL-7544) THORIUM BREEDER-REACTOR HISTORIES CALCULATED WITH GROM CODE. G. M. Benson (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 21, 1963. Contract W-7405-eng-48. 29p.

The GROM program was used to study the effect of fission product retention on core lifetime for a thorium breeder reactor operating at constant thermal power. The effective fission product (FP) yield was varied as follows: all FP yields set to zero; all rare-earth FP's assigned an effective yield of 10% of actual prompt fission yield based on thermal fission spectrum, whereas Mo^{95}, Tc^{99}, and Rh^{103} assigned actual prompt fission yields; and all FP's assigned actual prompt fission yields. The results show that GROM is an effective code for the analytical study of such reactor parameters. (auth)

17303 (NP-tr-1121) OPERATION REPORT ON THE BR2 REACTOR. Period Covered: March 31–April 21, 1963. K. J. Bobin (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Translated by L. G. Kemeny (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from report GEX-R-3. 17p.

The reactor continues to operate at a thermal power of 17 Mw giving a constant neutron flux of a maximum value of 2.6×10^{14} neutrons/cm^2 sec. The cycle (cycle 5) was marked by numerous accidental shut-downs caused by untimely drops of the control rods. Detailed information on the position of the control rods is presented. (P.C.H.)

17304 (NP-tr-1122) OPERATION REPORT ON THE BR2 REACTOR. Period Covered: April 21–May 12, 1963. K. J. Bobin (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). Translated by L. G. Kemeny (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from report GEX-R-4. 1963. 15p.

The reactor continues to work with the same configuration of 18 elements at a thermal power of 17.5 Mw. Irradiation experiments in positions of high flux are two capsules of stainless steel, one capsule of Be, and one of graphite. Capsules of Co and Ir are irradiated in the reflector for the production of isotopes. Flux measurements are also reported. (P.C.H.)

17305 NUCLEAR POWER AND SYSTEM CHARACTERISTICS. Milton F. Searl and George Y. Jordyl. Combustion, 35: 35-40(Aug. 1963).

The value of nuclear power plants relative to the utility system in which they are used is discussed from the standpoint of system ownership, size, and unit fuel cost. Various power reactor projects are cited; the utility system to which they are connected, ownership of the reactor, and an estimated fixed charge rate for the utility system are given. Extracted from USAEC Report TID-15329; NSA 16: 30096. (R.E.U.)

17306 THE ECONOMIC OUTLOOK FOR PROVEN-TYPE POWER REACTORS. Hans Michaelis. Euratom Bull., No. 1, 2-6(Mar. 1964).

The cost and profitability prospects of two proven reactors, gas-graphite and light-water reactors, are discussed. It is speculated that the breeder reactor system is now gradually developing and will probably predominate one day, but it will be a very long time before this type of reactor can supply its own plutonium. The economics of power reactors is considered on a long term basis. A method is also given for calculating the cost of generating electricity in nuclear power plants. (P.C.H.)

17307 ORGANIC COOLANTS ON TRIAL. Marcel Van Der Venne. Euratom Bull., No. 1, 7-13(Mar. 1964).

The advantages of using organic coolants are discussed. The choice of organic coolants was motivated by the fact that they have a number of very useful properties, notably low vapor pressure, good chemical compatibility with standard structural materials, very slight tendency to activation by irradiation, and usability at temperatures far above 300°C. On the other hand, they are decomposed by heat and irradiation, so that an attempt must be made to obtain an accurate idea of the various facets of this phenomenon as it arises. Special attention is given to the properties of biphenyl and ortho-, meta-, and paraterphenyl. It was concluded that terphenyls constitute a coolant that can be used in a power reactor in comparatively rigorous conditions and that at present it is not the behavior of this coolant that imposes limitations on a reactor string such as Orgel. (P.C.H.)

17308 AUTOMATIC TEMPERATURE CONTROL OF LARGE NUCLEAR REACTORS. W. I. McMillian (General Electric Co. Ltd., Portsmouth, Eng.). G.E.C. J. Sci. Tech., 31: No. 1, 11-20(1964).

Descriptions are given of electronic equipment that employs transistor circuit techniques for automatic temperature control for gas-cooled reactors. The essential requirements of the temperature control system are reviewed. (P.C.H.)

17309 ALPHA MONITORING PROCEDURES FOR EBR-I MARK IV PLUTONIUM FUEL ELEMENTS. W. B. Grant (Argonne National Lab., Ill.). Health Phys., 10: 203-4(Mar. 1964).

Procedures are described for monitoring finished EBR-I Mark IV Pu fuel elements for α contamination prior to their removal from the hood system and loading into the reactor. (C.H.)

17310 CHEMICAL PROBLEMS IN THE OPERATION OF THE DOUNREAY FAST REACTOR. J. L. Phillips (Dounreay Experimental Reactor Establishment, Caithness, Scotland). Ind. Chemist, 39: 186-94(Apr. 1963).

Operation of the Dounreay Fast Reactor is described. Chemical problems caused by the presence of small amounts of O, H, C, and N in the liquid Na–K heat transfer circuit are discussed. (P.C.H.)

17311 LA CROSSE BOILING WATER REACTOR (LACBWR) (Engineering Materials). (Chicago Operations Office. Reactor Engineering Div.). (CAPE-1096)

There are 518 pages of specifications and 28 engineering drawings (Title I) in this package. The La Crosse Boiling Water Reactor (LACBWR) is a direct-cycle, forced-circulation boiling-water reactor that is cooled and moderated by light water. The reactor operates at a pressure of 1300 psia and produces 165 Mwt. The reactor is controlled by 29 cruciform control rods. The core is loaded with 288 fuel elements having a total uranium content of 8600 kg. Each fuel element is composed of 25 fuel rods in 5×5 array which are loaded with UO_2 pellets that have been enriched to approximately 3.4%. The reactor and most of the equipment associated with the nuclear steam supply system are located in the containment building. The reactor is being developed under the Second Round Power Demonstration Reactor Program. (F.S.)

17312 OPERATING COEFFICIENTS AND REACTIVITY BEHAVIOR AT INDIAN POINT. R. M. Ball, J. M. Makepeace, and J. P. Farrar (Babcock and Wilcox Co., Lynchburg, Va.). 6p. (CONF-187-79)

From American Nuclear Society Meeting, New York, Nov. 1963.

Methods and results are given for temperature and power coefficients of reactivity. (R.E.U.)

17313 ML-1 NUCLEAR POWER PLANT INITIAL POWER TESTS. W. D. Wayne (Aerojet-General Nucleonics, San Ramon, Calif.). 14p. (CONF-39-109)

The testing of the ML-1 is discussed. Start-up profiles are included. (R.E.U.)

17314 POWER PLANT SYSTEM AND METHOD OF OPERATING THE SAME. (to Combustion Engineering, Inc.). British Patent 949,073. Feb. 12, 1964. Priority date Dec. 8, 1960, United States.

A power plant system, which has an overall favorable heat rate, which develops superheated steam that is delivered to the turbine, and which employs a nuclear reactor as the heat source, is described. The power generating system employs, in addition to a reactor cooled and moderated by a hydrogeneous fluid, such as water, a vapor-operated prime mover. The heated hydrogeneous coolant-moderator fluid is conveyed from the reactor and passed in indirect heat exchange with a fluid to be vaporized. The coolant-moderated fluid is returned subcooled to the reactor. The vapor produced by the indirect heat exchange is superheated by passing it in indirect heat exchange relation with the vapor phase of the hydrogeneous fluid. This superheated vapor is then conveyed to the turbine. (M.C.G.)

17315 NUCLEAR REACTORS. (to Brown, Boveri & Cie, AG). British Patent 952,200. Mar. 11, 1964. Priority date Sept. 15, 1959, Germany.

A thermionic reactor is designed for the direct production of electrical energy from the nuclear reaction. In the reactor, the fuel is located in a cooled outer jacket with an evacuated clearance between the fuel and jacket, and the width of the clearance is less than the mean free path of the electrons emitted by thermionic emission from the surface of the fuel. The design of the fuel elements and the arrangement of the core are described. (D.L.C.)

Process Heat Reactors

17316 EXPERIMENTAL LOW-TEMPERATURE PROCESS HEAT REACTOR PROJECT (Engineering Materials).

(Chicago Operations Office. Reactor Engineering Div.). (CAPE-993)

This package contains 218 drawings. The reactor is a closed-cycle, heterogeneous, pressurized-water-type reactor cooled and moderated by light water. The fuel is low-enrichment uranium dioxide pellets. The reactor is rated at 40 Mw(t). The facility consists of a reactor building, service building, and auxiliary external structures. (R.E.U.)

Production Reactors

17317 (HW-79614) LARGE-SCALE QUARRY BLASTING ON THE HANFORD RESERVATION. R. T. Jaske (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 15, 1964. Contract AT(45-1)-1350. 68p.

Two large-scale quarry blasts were conducted to produce crusher feed rock at a site central to the Hanford plutonium production areas. The blasts (3650 and 21,000 lb of NH_4NO_3) were ~20,000 ft from the nearest reactor. Seismic and acoustic measurements were made to confirm predictive techniques and to measure the oscillator response characteristic of critical reactor facilities. No detectable damage to plant facilities occurred. Correlations of the measurements with predictive techniques has led to improved techniques. (D.L.C.)

17318 (HW-SA-3409) PRODUCTION REACTOR TESTING FACILITIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 1964. Contract AT(45-1)-1350. 48p.

The Testing Subsection of the Research and Engineering Section, Irradiation Processing Dept., Hanford performs special tests and irradiations for other Hanford components. A summary is presented of the testing and irradiation services which are available, and the facilities used in the services are described. These services include in-reactor recirculating loops, other in-reactor testing, out-of-reactor loops, and examination, measuring, and monitoring. (D.L.C.)

Propulsion and Space

17319 (NAA-SR-6310) SNAP 2 POWER CONVERSION SYSTEM. ROTATIONAL SPEED CONTROL. Topical Report No. 18. W. E. Dauterman and E. J. Viton (Thompson Ramo Wooldridge Inc., TRW Electromechanical Div., Cleveland). Nov. 1962. For Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif. Contract [AT(11-1)-Gen-8], Subcontract N843FS-101221. 33p. (TRW-ER-5075)

The rotational speed control for the SNAP 2 power conversion system employs the concept of controlling speed by electrically loading the alternator. Speed is controlled in this manner to ±1% of nominal. This report covers work performed from March 1, 1960 to July 1, 1961. (auth)

17320 (NSEC-72) RADIOCHEMISTRY DURING START-UP AND EARLY OPERATION OF THE NUCLEAR SHIP SAVANNAH. Final Report. L. Battist, W. S. Winnowski, D. K. Dieterly, and R. C. Koch (Nuclear Science and Engineering Corp., Pittsburgh). July 1962. For New York Shipbuilding Corp., Camden, N. J. Contract AT (30-1)-3082, Subcontract 529-2082. 83p.

It was demonstrated that the radioactivity content of the primary system of the N.S. Savannah reactor plant was small and normal during the period of initial criticality and start-up, and during the sea trials and acceptance tests. The principal radioactive constituents (^{56}Mn, ^{41}Ar, ^{13}N, and ^{18}F) are either intrinsic to the primary system of the pressurized water reactor or are normally found in the coolant in concentrations comparable to those observed in this program. The ^{56}Mn concentrations observed at the various reactor power levels were slightly higher, relative to those for the other nuclides, than those observed in similar reactor plants. This slightly increased concentration is attributable to the fact that the coolant of this reactor was generally maintained between pH6 and pH7, whereas the primary coolants of the other plants were maintained at somewhat higher pH values. Data for fission product concentrations in the primary coolant indicate that their only significant source is uranium contamination of the reactor core surfaces. The observed concentrations do not represent any significant hazard or potential difficulty in plant operation. The small value of 5.6×10^{-2} $\mu g/cm^2$ for the surface density of uranium indicates that no significant contamination of these surfaces occurred during core fabrication. No significant defect in a fuel element cladding was detected during the period in which these measurements were performed. The efficiency of the demineralizer for removal of anionic and cationic radionuclides from the primary coolant was shown to exceed 90%. Volatile radionuclides were the only radioactive constituents found in the demineralizer effluent. Data obtained for the concentrations of gross radioactivity in the waste tanks were maintained below the maximum permissible concentrations for discharge to the environment. On the basis of these radiochemistry studies, it may be concluded that the N.S. Savannah primary coolant system exhibited a normal content and distribution of radionuclides and that those plant components for which radioactivity indicators or monitors were observed exhibited safe and normal operation behavior. (auth)

17321 (RTI/ING(63)-5) AN OUTLINE OF RULES FOR THE CONSTRUCTION OF NUCLEAR-PROPELLED MERCHANT SHIPS. F. Spinelli and A. DeBiase (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). June 1963. 20p.

The general background and the philosophy of the rules for nuclear-powered ships are described. The provisional rules are outlined for the architecture of the ship, the construction of the hull, containment vessel, secondary or safety shielding to containment vessel, nuclear assembly, special requirements relative to the propulsion apparatus and auxiliaries, and special requirements relative to the outfitting of nuclear ships. The rules for waste disposal and refueling and defueling are not yet defined. (D.L.C.)

17322 (TID-19971) HIGH ACCELERATION FIELD HEAT TRANSFER FOR AUXILIARY SPACE NUCLEAR POWER SYSTEMS. Annual Technical Report, September 1, 1962–August 31, 1963. H. F. Poppendiek, N. D. Greene, F. R. MacDonald, C. M. Sabin, R. K. Livett, and A. S. Thompson (Geoscience Ltd., Solana Beach, Calif.). Contract AT(04-3)-409. 113p. (GLR-15)

Research progress on high-temperature, liquid-metal heat and momentum transfer is reported. Liquid metal boiling and condensing were investigated analytically and theoretically, with emphasis on high-gravity or rotational flow. Both mercury and potassium were studied. (D.C.W.)

17323 MAGNETOHYDRODYNAMIC SPECIES SEPARATION IN A GASEOUS NUCLEAR ROCKET. R. A. Gross and K. O. Kessey (Columbia Univ., New York). AIAA (Am. Inst. Aeron. Astronaut.) J., 2: 295-301(Feb. 1964).

The possibility of steady flow separation of U^{235} from hydrogen by magnetohydrodynamically spinning the fluid

in a cylindrical vortex is considered. A gaseous nuclear rocket configuration is described and analyzed. The hydromagnetic equations are solved for the velocity distribution, pressure field, concentration of uranium and hydrogen, electrical power required, and dissipation rates as a function of Hartmann number and radial Reynolds' number. Some properties of a hydrogen plasma at a temperature of 1 ev are presented and potential rocket performance given. (auth)

17324 ALPHA SOURCES FOR LOW-THRUST TASKS IN SPACE. W. Diethorn (Pennsylvania State Univ., University Park). Intern. J. Appl. Radiation Isotopes, 15: 127-31 (Mar. 1964).

The recoil thrust exerted on a flat-plate α source was calculated for α particle escape from one side of the source. The thrust is low even for the high specific activity α emitters plonium-210, plutonium-238, and curium-244 now receiving increased production emphasis. It is suggested that these three α emitters may find some future applications in space exploration requiring low-thrust devices. (auth)

Research and Test Reactors

17325 (NP-13710) ELEKTRONNAYA APPARATURA UPRAVLENIYA I ZASHCHITY IMPUL'SNOGO BYSTROGO REAKTORA. (Electronic Control Apparatus and Shielding of a Fast Pulsed Reactor). Yu. A. Blyumkina, L. A. Kamaeva, V. F. Mamontov, and V. L. Cherevatenko (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1963. 18p.

Circuit diagrams are given for a pulsed fast reactor control system. (R.V.J.)

17326 (ORNL-TM-348) HRE-2 DESIGN REPORT. R. H. Chapman (Oak Ridge National Lab., Tenn.). Mar. 19[illegible]. Contract W-7405-eng-26. 356p.

A manual is presented which describes the design of the Homogeneous Reactor Experiment No. 2 in detail and which provides references to the many reports pertaining to the design and development of components. The description of the design is limited to that existing before operation commenced, with parenthetical descriptions of improvements. (D.L.C.)

17327 SCOTTISH RESEARCH REACTOR CENTRE. Engineer, 843-5(Nov. 22, 1963).

A description is given of the Scottish Research Reactor Center near Glasgow. The reactor (UTR-100) and its associated equipment and the physical plant are described. (R.E.U.)

17328 THE JOINT AN/CNEN/NPPC IRRADIATION PROGRAMME. H. Rose (International Research and Development Co. Ltd., Newcastle-upon-Tyne, Eng.), R. B. Gibbon, A. Gerosa, S. Moretti, C. Tribuno, and G. Cristiani. J. Nucl. Energy, Pt. A & B, 17: 491-504(Dec. 1963).

An account is presented of the development of the Joint AN/CNEN/NPPC Irradiation Program, originally mounted in 1959, which has made considerable progress in its objective to study the irradiation behavior of uranium and uranium alloys in the Italian Ispra-1 reactor. A description is given of the irradiation rigs and their associated instrumentation and control gear, together with facilities established in Newcastle to construct and test such rig equipment. The irradiation facilities of the Ispra-1 reactor, relevant to the program, are described, and operating experience with the first two irradiation charges is discussed. The post-irradiation facilities at Ispra and in the CNEN hot laboratories at Casaccia are also described, and handling experience with the first charge is summarized. (auth)

17329 THE VERTICAL CHARGE/DISCHARGE FACILITIES OF THE "DIORIT" RESEARCH REACTOR AT WÜRENLINGEN. K. Bula. Sulzer Tech. Rev. (Switz.), 45: 57-64(1963).

Descriptions of the fuel charge/discharge machine and two experimental changing machines serving the vertical channels in the Diorit research reactor are given. (P.C.H.)

17330 CROSS-POWER SPECTRAL MEASUREMENTS IN THE TWO-CORE UNIVERSITY TRAINING REACTOR-10. Richard A. Danofsky (Iowa State Univ., Ames). 50p. (CONF-332-12)

From Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla., Nov. 1963.

Random noise techniques were used to investigate the correlation between neutron fluctuations in the two subcores, the mode of propagation of neutron disturbances between the cores, and the reactivity coupling interaction between the cores of the UTR-10 (Argonaut-type) reactor. The cross-power spectral density function was derived using a theoretical model. (R.E.U.)

17331 IMPROVEMENTS IN OR RELATING TO SWIMMING-POOL NUCLEAR REACTORS. Olivier de Kervenoael and Alain Vernot (to Indatom). British Patent 951,658. Mar. 11, 1964. Priority date Jan. 7, 1960, France.

A cooling system for a swimming-pool reactor is designed which maintains the versatility and accessibility of the reactor while enabling its power to be increased. In the cooling system, cooling water is passed over the fuel elements within casings in mutually opposite directions and then collected, cooled, decontaminated, and returned to the pool water. (D.L.C.)

WASTE DISPOSAL AND PROCESSING

Refer also to abstract 16207.

17332 (HW-80526) RESEARCH AND DEVELOPMENT ACTIVITIES FIXATION OF RADIOACTIVE RESIDUES. Quarterly Progress Report, October–December 1963. E. R. Irish, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 1964. Contract AT(45-1)-1350. 38p.

The radiant-heat spray calciner in the High-Level Radiochemistry Facility was used for additional experimental studies of full-level waste calcination. The unit was operated with Redox waste, Purex waste plus sugar, Purex waste with phosphite added, and Purex waste to which cold fission products were added. Large (16 in.) diameter draft tubes, with and without fins, were the subject of a study to determine their effects on recirculation rates and feed capacities. The spray calciner off-gas filter overpressures were measured for various nozzle sizes, venturi shapes, filter permeabilities, and blowback air flow rate. The effect of composition on glass melting points, phase separation, and solubility was studied. Work on process and equipment for the hot cell glass experiment was carried on in cooperation with Brookhaven National Laboratory personnel. Work on the calciner melter was directed toward determining the melter capacity with two types of nonradioactive waste calcines. The use of immersion-type electric heaters in addition to heated air is being examined as an alternate low cost approach to heated air only for in-tank solidification. Thermodynamic data were obtained for three exchange reactions on eight inorganic ion exchangers. Pilot plant studies on intermediate-level waste treatment were continued. However, solids appeared recently in the condensate waste and caused processing difficulties. The solids contained a high concentration of bacteria, which may be due to raw cooling water being directed temporarily to the condensate receiver. Efforts are being made to correct this condition. Work was continued on defining flow sheet conditions for removal of cesium from Purex and Redox stored alkaline wastes. (auth)

17333 (IDO-14618) DEVELOPMENT OF A FLUIDIZED BED CALCINATION PROCESS FOR ALUMINUM NITRATE WASTES IN A TWO-FOOT-SQUARE PILOT PLANT CALCINER. PART III. INTERMEDIATE PROCESS STUDIES–RUNS 11 THROUGH 22. B. P. Brown, B. M. Legler, B. R. Wheeler, E. S. Grimmett, and J. A. Buckham (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Feb. 10, 1964. Contract AT(10-1)-205. 131p.

Intermediate process studies comprising twelve runs were made in a two-foot-square calciner to provide support data for the Waste Calcination Facility (WCF) and to study further the fluidized bed calcination process. For each run, the objectives, conditions, and results are given. Simulated aluminum reactor fuel processing wastes were calcined to a granular free-flowing solid under a variety of operating conditions and with various types of atomizing nozzles. Demonstration of the operability of the feed nozzle selected for use in the large-scale WCF and determination of the factors affecting the intra-particle porosity of alumina product were major results of these studies. The sodium concentration of the feed was shown to have a significant effect on the formation of alpha alumina in the product. Neither the presence nor absence of mercury in the feed had any detectable effect on calciner operation or product properties. (auth)

17334 (NP-13756(Vol.I)) STUDY OF PROBLEMS RELATING TO RADIOACTIVE WASTE DISPOSAL INTO THE NORTH SEA. I. OCEANOGRAPHICAL AND BIOLOGICAL CONDITIONS IN THE NORTH SEA. E. Wallauschek and J. Luetzen (European Nuclear Energy Agency, Paris). 1963. 51p.

After a definition of the North Sea area, a detailed discussion is presented of the oceanographical and biological conditions in the sea. Hydrographical connections between the North Sea and neighboring seas, and the inflow of fresh water from rivers are considered. Flora and fauna and the food chain in the area are discussed. Information is presented on the fishing activities in the area and on the seafood consumption habits in countries bordering the North Sea. (D.L.C.)

17335 (NP-13756(Vol.II)) STUDY OF PROBLEMS RELATING TO RADIOACTIVE WASTE DISPOSAL INTO THE NORTH SEA. II. GENERAL SURVEY ON RADIOACTIVITY IN SEA WATER AND MARINE ORGANISMS. E. Wallauschek and J. Luetzen (European Nuclear Energy Agency, Paris). 1964. 96p.

Data are presented on the presence of radioactive material (natural and artificial) in the marine environment and on the uptake, concentration, and release of such material by marine organisms. The data, in compiled form, were collected from many parts of the world. (D.L.C.)

17336 COLLOQUE INTERNATIONAL SUR LA RETENTION ET AL MIGRATION DES IONS RADIOACTIFS DANS LES SOLS. (International Conference on Retention and Migration of Radioactive Ions in Soils, Saclay, 16, 17, 18 October 1962). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 1-292(1963). Gif-sur-Yette, France, Centre d'Etudes Nucleaires, Saclay, France and Paris, Presses Universitaires.

Twenty-eight articles and the abstract of 1 film are included; separate abstracts were prepared for 21. Seven articles previously abstracted in NSA appear as 16: 25071, 16: 32619, 16: 34141, 17: 1159, 17: 2654, 17: 10820, 17: 29869. (P.C.H.)

For abstracts of individual papers see: 15761, 16010, 16207, 16208, 16215, 16216, 16217, 16239, 17337, 17338, 17339, 17340, 17341, 17342, 17343, 17344, 17345, 17346, 17347, 17348, and 17349.

17337 GROUND DISPOSAL: ITS ROLE IN THE U. S. RADIOACTIVE WASTE MANAGEMENT OPERATIONS. W. G. Belter (Atomic Energy Commission, Washington, D. C.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 3-10(1963).

Ground disposal in the U. S. is reviewed. Some of the most important aspects of the Hanford operation are considered briefly, and the monitoring program required is outlined. Three types of geologic formations that may be technically feasible for the discharge of liquid radioactive wastes are recommended for investigations: salt dome or bed; deep permeable formations containing connate brine; and excavation in impermeable formations. Development work accomplished to date in this field is summarized. Basic geochemical and geophysical studies have been de-

veloped to obtain better understanding of fission products movement in the ground in order to provide a basis on which sound waste disposal practices can be established. (P.C.H.)

17338 THE ROLE OF "GROUND DISPOSAL" IN RADIOACTIVE WASTE MANAGEMENT. J. F. Honstead (Agence Internationale de l'Energie Atomique, Vienna). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 11-15(1963).

The importance of understanding the specific role of a waste management process such as ground disposal is examined. The role must be specified before objective research and development is possible and is a prerequisite for communicating research progress. A general analysis of a schematic waste management situation was made to identify the purpose of its several components. Two situations are pointed out where the results of research into the retention and migration of radioactive ions in soils may be usefully applied. The first is in evaluation of subsurface, high level waste storage facilities. The second involves the discharge of low-level waste water. The utility of the ground disposal processes in each case are pointed out. The importance of a full understanding of the purpose and place of this technique in waste management philosophy to assure its acceptance and profitable application to specific problems is emphasized. (auth)

17339 AN INTERNATIONAL PROGRAMME OF GROUND DISPOSAL RESEARCH AND DEVELOPMENT. J. Beranek and I. C. Roberts (Agence Internationale de l'Energie Atomique, Vienna). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 17-20(1963).

Ground disposal is discussed in relation to an international program for encouraging the development and utilization of nuclear energy. Emphasis is given to discussion of: direct support of needed research and development work; co-ordination of national research and development programs; dissemination of information; technical assistance requirements of developing countries; and preparation of manuals of suggested practice by panels of experts. (P.C.H.)

17340 UNDERGROUND STORAGE CONDITIONS FOR RADIOACTIVE WASTES. J. Archambault and J. Lemoine (Bureau d'Etudes de Geologie Appliquee et d'Hydrologie Souterraine, Neuilly-sur-Seine, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 21-3(1963). (In French)

Underground storage of active wastes is discussed. Principal methods considered are: drums storage in natural or artificial (mines, tunnels) cavities, fixation of liquids effluents by the soil in the active circulation area of tracts, injection in the porous layers of deep structures, injection with fracturation of impermeable minerals (shale) at shallow depth, and settling in dissolution cavity created in soluble, but waterproof medium (salt layers). (P.C.H.)

17341 STATUS REPORT OF THE BELGIAN STUDIES PROGRAMME ON THE MOVEMENT OF RADIOELEMENTS IN SOILS. P. De Jonghe, L. Baetsle, W. Maes, and P. Staner (Societe Belge de Chimie Nucleaire, Mol. Belg.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 25-40(1963). (In French)

The most important subjects of the study are to predict the consequences of an accidental discharge of radioelements into the soil and to evaluate the reception capacity of the soil for solid materials with a known solubility and elution degree. The program consists of two essential parts and more specifically of the study of the water movement in the soil and the influence of retention due to the soil materials on the transportation of radioelements by the water. Injection of radiotracers and sampling of the groundwater were developed on a micro scale. In one case samples were taken by lowering copper rods or sheets that were activated by chemisorption of the radiotracer. Equipment of direct soil- and groundwatersampling was also developed. A thorough study was carried out on the retention phenomena of radioelements by sorption on the earth materials. This leads to the determination and calculation of relative velocities. Finally for the Mol site a first evaluation of the storage capacity was made for materials with known solubility and containing ^{137}Cs and ^{90}Sr. Actually, relatively important injections into the soil of ^{89}Sr and ^{137}Cs were prepared in order to verify the agreement between theory and field observation. (P.C.H.)

17342 ION EXCHANGE IN THE DEEP-WELL DISPOSAL OF RADIOACTIVE WASTES. D. G. Jacobs (Oak Ridge National Lab., Tenn.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 43-54(1963).

In order to evaluate the safety of injection of radioactive wastes into deep wells it is necessary to be able to predict the movement of the more hazardous radionuclides. Exchange of monovalent and divalent cations on numerous reference clay minerals and sandstone showed that the exchange potentials of the divalent alkaline earth cations are quite similar. Strontium is selectively sorbed over calcium by a factor of 1.25. Divalent cations are sorbed in preference to sodium by the clay minerals and the exchange is adequately described by the laws of mass action when the divalent cations occupy more than 10% of the total exchange sites. The sorption of trace quantities of strontium from a calcium-free sodium salt solution is greater than predicted for simple ion exchange, suggesting the presence of small quantities of sorption sites highly selective for divalent cations. Normalized strontium breakthrough curves coincide with normalized chloride breakthrough curves and show that radionuclide migration can be predicted by observing the dispersion of water in the disposal formation and correcting for the sorptive behavior of specific radionuclides. Exchange studies with Richfield sand, a typical deep-well disposal formation, suggest that in the disposal of ORNL low-level and intermediate-level wastes strontium will move only 1 and 10% as fast, respectively, as the transporting water due to ion exchange; calcium-strontium precipitation reactions will provide additional restrictions to radiostrontium movement. Cesium would move much more slowly than strontium because of highly selective exchange reactions. Ruthenium may move rapidly but is not likely to be hazard controlling. (auth)

17343 KINETICS OF ^{90}Sr RETENTION BY A CALCITE-PHOSPHATE REACTION EXTRAPOLATION ASSAY. Yves Belot and Claude Gailledreau (Centre d'Etudes Nucleaires, Saclay, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 69-83(1963). (In French)

The influence of different parameters was studied by way of synthetical solutions : length of columns, flowed volume, flow rate, ion phosphate concentration, and sodium concentration. From simple hypothesis, an extrapolation formula is stated and comparated with experimental results. In another way it is planned to use calcite columns, in order to treat waste waters. (auth)

17344 SELECTIVE ION EXCHANGE REACTIONS FOR CESIUM AND STRONTIUM BY SOIL MINERALS. Tsuneo Tamura (Oak Ridge National Lab., Tenn.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 95-104(1963).

The basis for discharge of low and intermediate activity wastes into the ground is the retention of the nuclides, particularly cesium and strontium, by ion exchange on the soil particles. Studies at Oak Ridge have shown that minerals with the mica structure are efficient in selectively sorbing cesium. For the low concentration of cesium generally found in wastes, ion-exchange capacity is seldom the controlling parameter for its removal. Biotite, a primary mica mineral, will sorb cesium even more efficiently than vermiculite even though biotite has about 1% the exchange capacity of vermiculite. In a demineralized water system, montmorillonite with 90-meq-per-100 g exchange capacity gave a distribution coefficient (Kd) of 1700 ml per g, whereas illite with 20-meq-per-100 g gave a Kd of 49,000. In the acidic pH range, ion exchange originating from isomorphous substitutions is the dominant mechanism for strontium removal by soils. In neutral and alkaline systems, additional reactions may occur. Hydrous oxides of iron and aluminum show high selectivities for strontium in this pH region. A Conasauga shale soil did not sorb as much strontium after being subjected to free iron oxide removal in spite of an increase in capacity resulting from the removal of the iron coating. An aluminum saturated montmorillonite showed the lowest removal of strontium at pH 6.0: when the pH was raised to 10, this sample removed more strontium than potassium, sodium, or calcium saturated samples. Knowledge of the mechanisms responsible for selective ion exchange reactions made possible the preparations of materials that show even greater selectivities than their natural counterparts. Thus, in solutions high in sodium nitrate concentrations, montmorillonite heated to 600°C and vermiculites saturated with potassium ions remove more cesium than the natural minerals. Gibbsite, an aluminum hydroxide mineral commonly found in soils, was made 50 times more selective for strontium by heating to temperatures that decomposed the mineral to the oxide. (auth)

17345 RETENTION AND ACCUMULATION OF ^{106}Ru + ^{106}Rh IN VARIOUS SAMPLES OF SOILS. P. Bovard, A Grauby, and J. Boyer (Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 141-50 (1963). (In French)

Ruthenium migration was studied in three types of soils: silt, pozdol, and compost. Successively the effects of permeability and of exchange potentials in radioisotope fixation are shown. Exchange potential is not sufficient to explain soil behavior. Absorption, indeed, seems clearly to depend on exchange capacity but other factors should be taken into account. Lixiviation tests were made on the three soil types. The results show that a small part of the fixed ions is swiftly transported but that the major portion seems to be strongly fixed. Results obtained thus far correspond to given working conditions. (auth)

17346 PRINCIPLE OF "GROUND DISPOSAL INJECTION" OF RADIOACTIVE SLUDGE. C. Caron, C. Gailledreau, and Y. Belot (Centre d'Etudes Nucleaires, Saclay), France). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 167-80(1963). (In French)

Research on radioactive sludges and cement mixed grouts injected according to miscellaneous techniques is described. The characteristics of several grout studied in terms of the kind of sludge incorporated and of the ground to be injected are given along with grout behavior in lixiviation by natural waters. (P.C.H.)

17347 SIGNIFICANCE OF CLIMATE IN RELATION TO THE DISPOSAL OF RADIOACTIVE WASTE AT SHALLOW DEPTH BELOW GROUND. R. M. Richardson (Geological Survey, Washington, D. C.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 207-11(1963).

Climate is of supreme importance in evaluating the suitability of sites for the disposal of radioactive waste at shallow depth below ground. To illustrate the profound importance of climate in relation to ground disposal operations, a number of sites in humid eastern United States where radioactive wastes are disposed at shallow depth below ground are described and compared with each other, and with two sites in arid parts of western conterminous United States. Consideration of conditions prevailing in these sites indicates that from the standpoint of results consequent to disposal or release, either deliberate or accidental, of radioactive waste to shallow depth below ground, sites in arid regions are in general infinitely more satisfactory than those in humid regions. In humid regions where radioactive waste is disposed at shallow depth below ground, the sorptive action of certain minerals in the soil is the only mechanism that prevents the rapid reappearance of radioactive ions in nearby surface water courses. Where the local soils do not immobilize the hazardous ions, structures of some sort must be provided for containment. (P.C.H.)

17348 MOVEMENT OF RUTHENIUM IN THE BED OF WHITE OAK LAKE. T. F. Lomenick (Oak Ridge National Lab., Tenn.). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 217-27(1963).

Currently, several thousand curies per year of ruthenium flow into the bed of former White Oak Lake from the ORNL intermediate-level wastes pits. As the waste water traverses the lake bed, a significant portion of the ruthenium is removed from solution. The ruthenium that is not sorbed on the lake-bed soil drains into White Oak Creek, a tributary of the Clinch River. An investigation was made to determine the quantity and distribution of ruthenium in the soil and to identify and define geohydrological factors affecting the movement of ruthenium through the lake bed. As of February 1962, the lake bed contained approximately 1200 curies of ruthenium. The ruthenium is present mainly in two areas or tracts on contamination, covering approximately 10 acres, that coincide roughly with the surface flow of waste over the bed. The highest concentrations of ruthenium occur in the uppermost few inches, and about 10% of the activity found is associated with the top 2 ft of soil. The lake bed is underlain by a thin layer of recent lacustrine sediment, several feet of alluvium, and the Conasauga shale formation of Cambrian age. Water-level measurements indicate that the depth to ground water varies from <1 to 5 ft below the surface. The subsurface migration of ruthenium follows closely the paths predicted from water-table contours. The rate of ground water movement in the upper 2 ft of soil varies from 1 to 5 ft per day, while movement in the material 2 to 5 ft below the surface ranges from 0.05 to 0.25 ft per day. Thus, the maximum rate of travel of ruthenium in the upper layers of soil is approximately twenty times that of the lower layers. Ruthenium is transported to White Oak Creek by surface water and ground water moving over,

through the bed of White Oak Lake. Only a small fraction of the ruthenium is transported by ground water through the lake-bed soil into the creek. The ruthenium moves at such a slow rate through the soil that radioactive decay reduces the concentration of that reaching the creek by subsurface movement to insignificant proportions. The amount of surface flow, and consequently, the quantity of ruthenium that reaches the creek from the lake bed, varies seasonally. During the dry summer months, drainage from the waste pits recharges the ground water in the lake bed. Thus, there is little surface flow and, consequently, little ruthenium that drains into White Oak Creek. However, in the wet winter season surface runoff from the lake bed is high and, therefore, larger amounts of ruthenium enter White Oak Creek. (auth)

17349 RETENTION AND MIGRATION OF RADIOACTIVE ISOTOPES IN THE LITHOSPHERE AT THE NATIONAL REACTOR TESTING STATION-IDAHO. Bruce L. Schmalz and W. Scott Keys (Atomic Energy Commission, Idaho Falls, Idaho). Colloq. Intern. Retention Migration Ions Radioactifs Sols, Saclay, 1962, 243-56(1963).

Aqueous liquids containing mixed fission and activation products in a concentration of the order of 10^3 μC/ml, plus tritium in a concentration of 10^3 μC/ml, are routinely discharged to ponds excavated in the alluvial regolith. Migration of radioisotopes through the regolith and basalt is delineated by samples from drill holes. The water and isotopes have been detected in the regolith at distances of 150 meters from the MTR-ETR disposal pond. The waste has been detected in perched water in the basalt at distance up to 1.5 kilometers. Migrating isotopes that have been identified are: tritium, chromium-51, cobalt-60, iodine-131, cerium-144, ruthenium-106, silver-110. Tritium, chromium-51, and cobalt-60 have been observed to be particularly migratory. The migration of cobalt-60 and cesium-137 has also been observed at other plant areas. The concentration of tritium diminishes with distance from the disposal pond. Because disposal is to the zone of aeration this cannot be explained on the basis of dilution. Ion exchange has been substantiated by laboratory studies. Columns filled with natural earth materials have shown that significant attenuation of tritium does occur despite relatively small column capacities. Migration of contaminated ground water resulting from disposal of waste at the NRTS is most extensively mapped on the basis of tritium analyses. Concentrations of 10^6 tritium units (T.U.) have been discovered at distances of 210 meters from a disposal well. Attenuation of the concentration to 1,200 T.U. at distances of 5 kilometers from the disposal point is observed. Attempts to trace contamination in ground water beyond 400 meters on the basis of isotopes other than tritium have been unsuccessful. Chemically contaminated wastes have also been traced to a distance of 5 kilometers. (auth)

17350 WASTE DISPOSAL. Reactor Fuel Process., 7: No. 1, 54-70(Winter 1963-64).

Development of methods of waste processing, including treatment of liquid wastes by ion exchange and foam separation and conversion of high-level-activity wastes to solids, is reviewed. Recovery of fission products from wastes is discussed. Land burial operating experience and Savannah River Plant is described. (32 references). (M.C.G.)

GENERAL AND MISCELLANEOUS

17351 (BMI-1659(Del.)) PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING DECEMBER 1963. Russell W. Dayton and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Jan. 1, 1964. Contract W-7405-eng-92. 60p.

Research progress is reported on reactor materials and components, fuels, general fuel-element development, radioisotope and radiation applications, development of a tracer system for in-place filter evaluation, coated particle fuel materials, corrosion studies of the Fluoride Volatility Process, the USAEC-AECL cooperative program, fission product deposition studies, gas-cooled reactor program, and joining of regenerative cell components. (M.C.G.)

17352 (CONF-417-6) DIPOLE MOMENTS OF EXCITED ELECTRONIC STATES OF MOLECULES: THE $^1A_2$ STATE OF FORMALDEHYDE. D. E. Freeman and William Klemperer (Harvard Univ., Cambridge, Mass.). [1963]. Contract [AT(30-1)-2382]. 8p.

From American Physical Society Meeting, Pasadena, Calif., Dec. 1963.

Stark splittings of some rotational lines of the 3390 Å band were measured to determine the dipole moment of this excited electronic state of formaldehyde. The spectrogram obtained with a plane echelle spectrogram is presented. Values for the dipole moment of the excited vibronic state, which were derived from each observed Stark splitting by a calculation in which both vibronic states are treated as rigid planar symmetric tops, are tabulated. The dipole moment was found to be 1.48 ± 0.07 D. (L.B.S.)

17353 (HW-68600-35) PLUTONIUM ABSTRACTS. Volume 4, Number 1. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 1, 1964. Contract AT(45-1)-1350. 33p.

A total of 45 abstracts is presented on new developments in plutonium technology. The abstracts are arranged according to the following subjects: chemistry, health and safety, metallurgy and ceramics, physics, reactor technology, and miscellaneous. (D.L.C.)

17354 (IS-639) NORMAL ELLIPTIC INTEGRALS OF THE FIRST AND SECOND KINDS. B. C. Carlson (Ames Lab., Ames, Iowa and California Inst. of Tech., Pasadena). [Apr. 1, 1963]. Contract [W-7405-eng-82]. 26p.

A set of normal elliptic integrals that appears to be suitable for use in integral tables and numerical work is described. The usefulness of the integrals is demonstrated by evaluating some definite integrals related to the geometry of ellipses and ellipsoids. (auth)

17355 (MIT-1965-7) THERMODYNAMIC, SPECTRAL AND STRUCTURAL STUDIES OF COMPLEX IONS. Annual Report. (Massachusetts Inst. of Tech., Cambridge). Mar. 31, 1964. Contract AT(30-1)-1965. 15p.

Vibrational Spectra, Structure, and Bonding in Metal Carbonyls. The research on the effects of neutral and monovalent ligands on the bonding in Mo and Mn carbonyls is described. Results to date on $NH_3Cr(CO)_5$ are summarized briefly. Metal Atom Cluster Compounds. The compound $ReCl_3[(C_6H_5)(C_2H_5)_2P]$ was found to be a trimer with the same structure as the $Re_3Cl_{12}^{3-}$ ion. Results of a molecular orbital treatment of the delocalized metal-to-metal bonding in the $Re_3Cl_{12}^{3-}$, $Nb_6X_{12}^{2+}$, $Ta_6X_{12}^{2+}$, $Mo_6X_8^{4+}$, and Mo_3O_{13} clusters are summarized briefly. Pseudo Lattice Energies and Metal-Ligand Bond Energies. The calculation of the pseudo-lattice energy and the complexation or ligation energy is discussed for several complex ions. The relative stability of the $[MX_4]^{2-}$ species in $[As(C_6H_5)_3CH_3]_2[MCl_4]$ is discussed with reference to the hydration reaction of $[MCl_4]^{2-}$. Chemistry of Rhenium(III). Besides its trinuclear complexes ($Re_3X_9L_3$), rhenium(III) appears to have binuclear complexes; the major binuclear species is $Re_2Cl_8^{2-}$. (D.L.C.)

17356 (ORNL-TM-579) A MANUAL OF CATALOGING RULES AND PRACTICE FOR USE IN THE CATALOGING SECTION OF OAK RIDGE NATIONAL LABORATORY LIBRARY. Second Revised and Augmented Edition. Margaret McLeod (Oak Ridge National Lab., Tenn.). Mar. 1964. Contract W-7405-eng-26. 92p.

This manual presents the rules used in the descriptive cataloging for the physical description and identification of books, and in the format and style of the cards for the different entries under which the book is indexed. Numerous samples are used for illustrative purposes. (D.L.C.)

17357 (SC-DC-64-378) PROCESS START AND CONTROL PROCEDURES. [T. P. Conlon] (Sandia Corp., Albuquerque, N. Mex.). [Mar. 1964]. Contract [AT(29-1)-789]. 26p.

Procedures utilizing statistical techniques and sequential analysis are given to provide a rapid means for determining whether a process setting is satisfactory in relation to specification limits. The procedures can be used to verify process settings at set-up and at periodic intervals during the subsequent production run. The feasibility of these procedures was demonstrated in a manufacturing environment. Quality levels of 0.5, 1.0, and 2.0% are used in these procedures. (D.L.C.)

17358 (SC-R-685) A METHOD FOR PERFORMING A HUMAN-FACTORS RELIABILITY ANALYSIS. A. D. Swain (Sandia Corp., Albuquerque, N. Mex.). Aug. 1963. Contract AT(39-1)-789. 60p.

A method for performing a human-factors reliability analysis is a man-machine system is described. The outcome of this type of analysis is a quantitative assessment of the estimated degradation of a man-machine system resulting from human errors. The method represents an extension of a quantitative approach to reduction of human error in industrial production. (C.H.)

17359 (SCL-TM-64-34) INERTIAL LOAD ON A PLATE UNDER BLAST LOADING. H. C. Merchant (Sandia Corp. Livermore Lab., Livermore, Calif.). Feb. 1964. Contract [AT(29-1)-789]. 10p.

The approximate design load (inertial load) for a rectangular plate exposed to blast loading is expressed in terms of the dimensions and fundamental frequency of the plate for a given explosive charge. (auth)

17360 (TID-18775) TRANSIENT RESPONSE OF LINEAR UNDAMPED AND LIGHTLY DAMPED LUMPED SPRING-MASS SYSTEMS BY GRAPHICAL TECHNIQUES (thesis). Richard O. Brooks (New Mexico. Univ., Albuquerque and Sandia Corp., Albuquerque, N. Mex.). 1963. Contract [AT(29-1)-789]. 144p. (SC-DC-3240)

Phase-plane-delta graphical methods are developed

which are suitable for solving the acceleration or displacement responses (also spring deflection) of an undamped, coulomb-damped, or viscously damped lumped spring-mass system that is disturbed through its supports. Only lightly damped systems with two or more significant cycles of free vibration are considered. The support excitations are restricted to half sine, symmetrical triangle, terminal peak sawtooth shapes, and to step functions. The phase-plane-delta methods developed are checked against analytical solutions. The graphical method is then used to predict responses of actual models which were subjected to shock tests; the measured responses are compared with the predicted responses. Investigation of using the phase-plane-delta method to find responses of a general two-degree system reveals that an undamped two-degree system must meet certain requirements in regard to the type of excitation. A damped two-degree system is found to have so many restrictions that a graphical solution is impractical construction of the phase planes for specific types of system support excitation and system response is outlined. (auth)

17361 (TID-20353) THE BIOCHEMISTRY OF SENESCENCE IN PLANT CELLS. Progress Report, June 15, 1963 to March 15, 1964. J. E. Varner (RIAS, Div. of Martin Co., Baltimore). Contract AT(30-1)-3232. 21p.

Progress is reported in studies on the biochemistry of senescence in plant cells. The hypothesis that senescence is the final phase of differentiation and is under genetic and metabolic control was tested in barley seeds using labeled amino acids. Data are presented on the effects of hydrolytic enzymes, gibberellic acid, and actinomycin D on the synthesis of nucleic acids in barley seeds, with and without the endosperm. (C.H.)

17362 (TID-20355) NEW TRACER TECHNIQUES FOR EVALUATING THE EFFECTS OF AN INSECTICIDE ON THE ECOLOGY OF A FOREST FAUNA. Final Report, December 1, 1960–November 30, 1963. Tony J. Peterle and Robert H. Giles, Jr. (Ohio State Univ. Research Foundation, Columbus). Jan. 1964. Contract AT(11-1)-967. 444p.

The faunal ecology of two deciduous-forested, 20-acre water-sheds near Dover, Ohio, was studied intensively for one year. The second year, one of the watersheds was aerially sprayed with 2 lb/acre of malathion labeled with ^{35}S. Effects of the insecticide were studied by sampling all faunal segments from the microbiota of the soil to raccoons. The insecticide and its metabolites were followed from the airplane through the air, the forest vegetation, and in soil and water. Results indicate that malathion is an effective insecticide that, although harmful to some forms, is of short residue and permits rapid recovery of decimated or altered populations. (C.H.)

17363 (TID-20363) A RESURVEY OF THE MACROSCOPIC BENTHIC FAUNA OF SELECTED SITES OFF CAPE COD. Final Report. John S. Rankin, Jr. (Connecticut. Univ., Noank. Marine Research Lab.). Mar. 16, 1964. Contract AT(30-1)-2776. 53p.

An inventory of the macroscopic benthic fauna was repeated off Cape Cod, Massachusetts as to: kinds of animals present and abundance of each; relation between fauna and sediments; and stability of communities present. Procedures used and data collected are presented for both a 1959 and a 1961 survey. About 280 species of macroscopic animals (exclusive of fish) were identified: 185 were from the first trip. The increased number of species found on the first trip appeared to be attributable to more efficient collecting technique. Species according to areas and sediment analyses are included. (H.M.G.)

17364 (UCRL-11179) BRAIN SEROTONIN AND BEHAVIOR IN SELECTED STRAINS OF RATS (thesis). Gordon T. Pryor (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 1964. Contract W-7405-eng-48. 286p.

Possible relations between non-cholinergic neurohumoral systems in brain and behavior were investigated. Three sets of experiments were performed with this in mind. First, strain differences in brain serotonin, DL-3,4-dihydroxyphenylalanine decarboxylase (DOPAD), glutamic acid decarboxylase (GAD) and monoamine oxidase (MAO) activities were investigated together with cholinesterase (ChE) and acetylcholinesterase (AChE) activities, and the results were related to known behavioral differences between the rat strains. Second, the S_1 and S_3 strains were investigated more thoroughly with respect to within-strain correlations between brain serotonin and behavior. Third, the direction of study was reversed, and the effects of environmental stimulation on brain serotonin were investigated in the S_1 and S_3 strains. (auth)

17365 (AEC-tr-6362) ON PRIMARY EFFECTS OF PHOTOTROPIC PERCEPTION. Brief Summary of a Lecture Given at the Session of Botanists in Hamburg, September 1963. M. H. Zenk. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Ber. Deut. Botan., Ges., 76: 329(1963). 2p.

The differences between apical and basal phototropism were discussed first and the mechanisms of the curvature reactions examined. Whereas the Cholodny-Went theory has been proven by Thimann to be applicable for the interpretation of the first and second positive curvature of oat and corn coleoptiles by measurement of the deflection of the current of the growth substance by using C^{14}-labeled indoleactic acid (IES), no evidence has been found yet for the support of the indoleacetic acid-photolysis theory in vivo. The basis for research was the working hypothesis that at the third positive curvature photooxidations occur in the cell. The dependence of the coleoptile naphthylacetic acid decarboxylation upon the light-dark change, the temperature, and the energy requirements of the reaction were studied. On the basis of chromatographic studies it was found that this light acceptor was a hitherto unknown flavin together with small amounts of free riboflavin. The distribution of the flavin in the coleoptiles showed, that the concentration in the tip of the organ was lower than in the base. The investigation of the intracellular distribution of the flavin showed that approximately 10% were firmly attached to the wall of the cell. Some photochemical properties of the flavin were described and a hypothesis for the reaction courses of the basal phototropism was developed. (auth)

17366 (AEC-tr-6363) D-TRYPTOPHAN IN HIGHER PLANTS. M. H. Zenk and H. Scherf. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Biochim. Biophys. Acta, 71: 737-8(1963). 3p.

Tryptophan derived from malonyl-tryptophan isolated from Caragana arborescens or from ripe pomes was proved to be the d-amino acid. The d-tryptophan present in the plant conjugate, found to be α-N-malonyl-d-tryptophan, was also detected chromatographically in many other species. (H.M.G.)

17367 (AEC-tr-6376) OBSERVATION ON THE INFLUENCE OF AN ELECTRIC CURRENT ON SEGREGA-

TION. R. Tougas and A. Hone. Translated by John H. Trapp (National Lead Co. of Ohio, Cincinnati), from Can. Met. Quart., 2: 281-9(July-Sept., 1963). 6p.

The effectiveness of zone melting for metal ingot purification depends on how small the effective partition coefficient k is for any one impurity. An investigation was conducted to study the influence of an electric current on k for Sn–2% Pb alloy. The heating of the Sn–Pb ingot was performed first with h-f induction and then with a d-c current of 225 amp/cm^2, and the speed was varied from 5 to 50 cm/hr. The results show that d-c heating gives a greater segregation effect (smaller k values) than h-f induction, and that this effect is greatest when the metal ingot is connected to the negative terminal. The speed at which k approaches unity (zero segregation) is 20 cm/hr for induction heating and 50 cm/hr for d-c heating with negative connection. (D.L.C.)

17368 (AI-Trans-37) CHEMICAL ACTIVITY OF HYDROGEN DESORBED FROM PALLADIUM AND ITS ALLOYS. Jacques Benard and Philippe Albert. Translated by Anthony Cornell (Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif.), from Compt. Rend., 224: 45-7(1947). 4p.

The method of immersion in an oxidizing solution and subsequent titration of the reduced reagent was used to measure the desorbed, chemically active hydrogen from Pd sheets. The oxidizing solutions used were decinormal solutions of ferric sulfate and potassium permanganate, with the former giving the most reproducible results. Some of the results obtained on Pd and Pd–Au alloys are described, and it is concluded that the desorbed hydrogen is in the atomic state. (D.L.C.)

17369 (ANL-Trans-4) CHRONICLE. II. ALL-UNION CONFERENCE ON CALORIMETRY. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Zh. Fiz. Khim., 37: 2379-87(1963). 12p.

The II All-Union Conference on Calorimetry was held in Leningrad on June 17 to 22, 1963. The papers and reports that were presented at the conference are summarized briefly. Some of the topics covered were: calculations, thermodynamical units, experimental techniques, heats of adsorption, combustion heats, enthalpies of formation, and other thermodynamic properties of various compounds and elements. Progress in calorimetry is summarized, and conference recommendations for supporting work are given. (D.L.C.)

17370 (SC-T-64-44) ION AND ELECTRON CONDUCTION IN BINARY OXIDES AND THEIR STUDY BY MEANS OF E.M.F. MEASUREMENTS. Hermann Schmalzried. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Z. Physik. Chem. (Frankfurt), 38: 87-102(1963). 17p.

A theoretical investigation was carried out of the chain $O_2(p'_{O_2})$, Me/solid oxide/Me, $O_2(p''_{O_2})$, in order to obtain general statements regarding the emf as a function of the ionic and electronic conduction in a binary oxide electrolyte. A discussion is presented of test data gained from MgO, Al_2O_3, ZrO_2 (+CaO), SiO_2 (quartz glass), rare earths, and mixed crystals consisting of SiO_2 and Al_2O_3 as solid electrolytes at high temperatures. These discussions are based on the derived equations. (auth)

17371 (SC-T-64-65) PROPERTIES OF RUBBER TYPES IN RELATION TO ITS STRUCTURE. J. Royo. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Rev. Plasticos (Madrid), 14: 49-52(1963). 9p.

A general treatment is presented of the relations between the properties of elastomers and their structure, with particular attention to natural and synthetic rubber. The tendency toward crystallization on elongation is discussed in terms of molar cohesion for several high polymers. The effects of spatial configuration of the chain on its elasticity are next considered, and the arrangement of simple C-C bonds in gutta percha and rubber is discussed. The effects of methyl group substitution, 3-dimensional bonds, and lampblack addition are described. A table is presented which gives the qualitative effects of structural characteristics on the properties of high polymers. (D.L.C.)

17372 (UCRL-Trans-992(L)) GENERATION OF TRANSVERSE WAVES BY DIRECTED EXPLOSIONS. B. L. Kaplan and V. V. Maiorov. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore), from Razved. i Promysl. Geofiz., Vses. Nauchn. Issled. Inst. Geofiz. Metodov Razvedki, No. 36, 14-23(1960). 15p.

Experiments using a hydrogun and a drop hammer were conducted to investigate the possibility of using directional explosions for transverse wave excitation. Compared seismograms of the explosion in the tubes of the hydrogun with the impact of the drop hammer showed the same waves. The effects of a series of factors (varying the length of the charge, the distance of the charge from the support, the mass of the stemming) on the energy transfer from the explosions to the ground were studied to determine the optimum efficiency of the hydrogun. Calculations of Sadovskii were reproduced and were found to be in excellent agreement with experimental results. Tests were also conducted using flat superposed charges. Test results are given and seismograms of explosions are compared with those derived from mechanical sources. (L.B.S.)

17373 (UCRL-Trans-1033) A LIPID COMPONENT OF ARTERIAL ELASTICA. HISTOCHEMISTRY AND MICROSCOPY BY FLUORESCENCE. V. Preto Parvis and A. Ugo. Translated for Univ. of California Lawrence Radiation Lab., Berkeley, from Boll. Soc. Ital. Biol. Sper., 39: 657-9(1963). 6p.

Histochemical techniques are described for the demonstration of lipids in elastic tissues of blood vessels. The use of fluorescent dyes and other dyes and chemicals in the preparation of cat aorta for microscopic examination under fluorescent light is described. (C.H.)

17374 (UCRL-Trans-1043(L)) PRODUCTION OF COBALT TRIFLUORIDE. Nobuatsu Watanabe, Yoji Ohara, Tsuyoshi Tanigawa, and Shiro Yoshizawa. Translated for Univ. of California, Lawrence Radiation Lab., Livermore, from Kogyo Kagaku Zasshi, 65: 1168-70(1962). 11p.

The following conclusion has been reached after some investigations made to determine whether cobalt fluoride can be produced by the reaction of cobalt oxide and fluorine, the conditions under which it is produced, and the reaction process: (1) Cobalt oxide(III) is reacted by fluorine, forming cobalt fluoride(III) at a temperature higher than about 55°C. Cobalt oxide(II), on the other hand, is not reacted at such low temperatures, but it also produces cobalt fluoride(III) by the same reaction at a temperature higher than about 120°C. (2) In the reaction process of cobalt oxide(III) and fluorine, cobalt fluoride of high atomic value is produced first, and it is believed that the entire reaction is accelerated by its catalytic action. (auth)

17375 PRECIS D'ENERGIE NUCLEAIRE. (Summary of Nuclear Energy). G. Cahen and P. Treille, eds. Paris, Dunod, 1963. 483p.

The principles and technology of nuclear energy are reviewed. An appropriate background in modern and nuclear physics is provided; and reactor theory, design, characteristics, and construction are covered. The various radiations and their effects and measurement are discussed, together with the necessary protection against them. Uses of nuclear energy and radiations are also considered. (D.C.W.)

CORPORATE AUTHOR INDEX

This index contains entries for this period for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

AERO VAC CORP., TROY, N. Y.

Prog. rpt. on O–Nb reaction, 18: 16425 (NP-13741)

AEROSPACE CORP., EL SEGUNDO, CALIF.

Energy transfer processes in partially ionized two-temperature gas, 18: 16549 (ATN-64(9232)-1)

Prog. rpt. on low-temperature electronics, 7–12/62, 18: 16878 (SSD-TDR-63-98)

AKADEMIYA NAUK S.S.S.R.

Green's functions and graphical method in finite systems, 18: 16763 (NP-13701)

Mechanical properties of construction materials under neutron radiation, 18: 16525 (NP-13657)

Polarization of cosmic muons and determination of ratio $K^+/K^+ + \pi^+$, 18: 16762 (NP-13694)

Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)

AKADEMIYA NAUK UKR. S.S.R.

Energy levels of nuclei of Cl-35 and K-41, 18: 16945 (NP-13601)

Filling of magnetic trap GVL-2 with plasma, 18: 17108 (NP-13609)

Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)

Motion of plasma bunch in magnetic field of toroidal solenoid, 18: 17113 (NP-13698)

Plasma injection into magnetic trap, 18: 17110 (NP-13623)

Vacuum gage using a-c gas discharge, 18: 16278 (NP-13717)

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.

Bibliography on radiation effects on nuclear fuel materials, 18: 16529 (VDIT-16(4.1))

ALUMINUM CO. OF AMERICA. ALUMINUM RESEARCH LABS., NEW KENSINGTON, PENNA.

Tritium decoration of defect structures in Al, 18: 16478 (TID-7688 (p.44-9))

AMES LAB., AMES, IOWA.

Chemical analysis of alkali metal W bronzes, 18: 15952 (IS-800)

Environmental radioactivity, 18: 16205 (TID-20369)

Photoneutron resonance in O-16, 18: 16943 (IS-676)

ARGONNE CANCER RESEARCH HOSPITAL, CHICAGO.

Animal scanning system, 18: 15763 (ACRH-20(p.136-43))

Diagnostic uses for Tc-99m, 18: 15913 (TID-7689(p.1-11))

Nuclear needle for neurosurgery, 18: 15912 (ACRH-20(p.25-36))

Percutaneous cordotomy for pain, 18: 15734 (ACRH-20(p.37-46))

Prog. rpt. on biological research, 9/63, 18: 15733 (ACRH-20)

Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689 (p.17-20))

ARGONNE NATIONAL LAB., ILL.

Analysis of $Cr^{52}(d,p)Cr^{53}$ reaction, 18: 16913 (ANL-6848(p.63-9))

Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848(p.226))

Analysis of $Zr^{90}(d,p)Zr^{91}$ stripping reaction, 18: 16909 (ANL-6848(p.30-7))

Angular momentum selection and angular correlations in direct reactions with strongly absorbed particles, 18: 16927 (ANL-6848(p.147-52))

Conference on nuclear spectroscopy with direct reactions, University of Chicago, 3/64, 18: 16905 (ANL-6848)

Corrosion of Al powder products, 18: 16438 (ANL-6785)

Coulomb-wave stripping amplitudes, 18: 16910 (ANL-6848(p.38-42))

Deuteron-γ angular correlation in $Mg^{24}(d,d'\gamma)$, 18: 16922 (ANL-6848 (p.123-4))

Direct reaction contributions to fluctuating reaction cross sections, 18: 16938 (ANL-6848(p.228-9))

Elastic and inelastic scattering of 40-Mev protons, 18: 16924 (ANL-6848 (p.130-6))

Elastic scattering of 17-Mev protons from heavy nuclei, 18: 16920 (ANL-6848(p.114-17))

Excitation of $T = T_z + 2$ states, 18: 16923 (ANL-6848(p.125-9))

Finite-range n-p potential in Coulomb stripping reactions, 18: 16911 (ANL-6848(p.43-50))

Fluid-bed fluoride volatility processes. V., 18: 16076 (ANL-6812)

Inelastic scattering of 44-Mev α particles in medium-weight nuclei, 18: 16925 (ANL-6848(p.137-42))

Inelastic scattering of α particles from C-12, Mg-24, Si-28 and Fe-56, 18: 16928 (ANL-6848(p.153-8))

Isobaric analogue states and intermediate resonances in nuclei, 18: 16926 (ANL-6848(p.143-6))

Neutron polarization and cross sections for $C^{13}(d,n)N^{13}$ reaction, 18: 16908 (ANL-6848(p.16-23))

Neutron reduced widths by $N^{14}(N^{14},N^{13})N^{15}$ transfer reaction, 18: 16929 (ANL-6848(p.160-7))

Normal elliptic integrals of first and second kinds, 18: 17354 (IS-639)

Nucleon capture reactions near A = 40, 18: 16931 (ANL-6848(p.177))

Parity rule for inelastic scattering at small angles, 18: 16921 (ANL-6848(p.118-22))

Particle hole calculation of $Ca^{40}(\alpha,\alpha')$, 18: 16919 (ANL-6848(p.108-13))

Pion nuclear elastic charge-exchange scattering, 18: 16939 (ANL-6848 (p.236-9))

Reaction $U^{235}(d,p)U^{236}$, 18: 16912 (ANL-6848(p.52-62))

Reactions (d,n) on Fe-54 and Ni-58, 18: 16917 (ANL-6848(p.98-103))

Reactions (He^3,n), 18: 16935 (ANL-6848(p.199-207))

Reactions $Mg^{24}(d,p)Mg^{25}$ and $Mg^{24}(t,d)Mg^{25}$, 18: 16918 (ANL-6848(p.104-5))

Reactions $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3,He^4)O^{16}$, 18: 16907 (ANL-6848 (p.8-15))

Reactions (p,t), (p,He^3), and (p,α) on O-16, 18: 16936 (ANL-6848 (p.208-16))

Reactor Fuel Processing, Vol. 7, No. 1, 18: 16150

Scattering of protons by Ho-165, 18: 16940 (ANL-6848(p.24-9))

Selection rule in $Ti^{48}(p,p')$ inelastic scattering, 18: 16930 (ANL-6848 (p.168-71))

Singlet di-nucleon state in nuclear reactions, 18: 16932 (ANL-6848 (p.180-1))

Stripping and pickup reactions on C-12, C-13, and C-14, 18: 16914 (ANL-6848(p.70-8))
Strongly populated levels of $(d_{3/2})^3$ and $(f_{7/2})^3$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))
Study of (d,p) reactions on targets of W-182, W-184, and W-186, 18: 16916 (ANL-6848(p.86-97))
Theory of intermediate structure, 18: 16941 (ANL-6848(p.241-8))
Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))
Two-nucleon stripping reactions, 18: 16934 (ANL-6848(p.188-98))
Validity of WKB approximation for high-energy distorted wave calculations, 18: 16906 (ANL-6848(p.2-7))

ATOMIC POWER DEVELOPMENT ASSOCIATES, INC., DETROIT.
EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)

ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
SNAP-2 rotational speed control, 18: 17319 (NAA-SR-6310)

AVCO CORP. AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
Aerodynamic aspects of magnetospheric flow, 18: 16629 (AD-430410)
Electrode nonuniformities magnetic field in MHD generators, 18: 16741 (BSD-TDR-63-248)
Radiant energy loss from Cs–Ar plasma, 18: 17105 (BSD-TDR-64-6)

B

BADGER (W. L.) ASSOCIATES, INC., ANN ARBOR, MICH.
Production of potable H_2O from aqueous wastes in shelter, 18: 16228 (NP-13740)

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Blast loading of outer containment structures for reactors, 18: 17258 (BRL-Memo-1530)

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Filter efficiency in removal of oil mist from compressed air, 18: 16388 (TID-7688(p.78-80))
Mathematical models of fission-product deposition, 18: 17248 (BMI-X-278)
Prog. rpt. on civilian applications, 12/63, 18: 17351 (BMI-1659(Del.))
Prog. rpt. on D_2O-moderated reactors, 12/63–2/64, 18: 16467 (BMI-X-277)
Tensile fracture and microstructure of U, 18: 16466 (BMI-1664)

BATTELLE MEMORIAL INST. INTERNATIONAL DIV., GENEVA.
Etch-pit observations concerning twins in Fe and Fe alloys, 18: 16471 (EURAEC-978)

BOLOGNA. UNIVERSITÀ.
Prog. rpt. on diffusion and precipitation of hydrogen in Zr, 6–9/63, 18: 16469 (EURAEC-821)

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Accelerators with nonlinear focusing, 18: 16599 (BNL-7534(p.399-405))
Alternative activity to storage rings—high-intensity AGS, 18: 16596 (BNL-7534(p.379-84))
Beam survival in Cosmotron, 18: 16588 (BNL-7534(p.228-9))
Brookhaven coil construction program, 18: 16603 (BNL-7534(p.448))
Can cosmic rays replace accelerators?, 18: 16729 (BNL-7534(p.29-38))
Coherent vertical instabilities in MURA 50-Mev electron accelerator, 18: 16594 (BNL-7534(p.368-74))
Colliding beams to study intermediate boson, 18: 16752 (BNL-7534 (p.308-11))
Comments on colliding beams, 18: 16753 (BNL-7534(p.312-17))
Conference on storage rings, accelerators and experimentation at super-high energies, Brookhaven 6/10–7/19/63, 18: 16583 (BNL-7534)
Cosmic ray results at ultra-high energies, 18: 16728 (BNL-7534 (p.2-28))
Elastic scattering of $\pi^{\pm}$-p, K^+-p, $\bar{p}$-p, and p-p, 18: 16749 (BNL-7534 (p.83-7))
Experimental programs for 1000-Bev and 30-Bev accelerators, 18: 16584 (BNL-7534(p.39-48))
Experimental results from Stanford electron storage ring, 18: 16595 (BNL-7534(p.375-8))
Experimentation with colliding proton beams, 18: 16592 (BNL-7534 (p.277-307))
Experiments with neutron gas targets, 18: 16600 (BNL-7534(p.406-13))
High-energy physics with large heavy-liquid bubble chamber, 18: 16293 (BNL-7534(p.107-12))
Intensity limitations imposed by transverse space-charge effects in circular particle accelerators, 18: 16593 (BNL-7534(p.324-67))
Italian storage rings, 18: 16586 (BNL-7534(p.171-208))
Magnetic field shaping by superconducting surfaces, 18: 16604 (BNL-7534(p.449-77))
Method for injection into betatron phase space, 18: 16601 (BNL-7534 (p.414-16))
p-p Elastic scattering with colliding beams, 18: 16751 (BNL-7534 (p.238-52))
Physics with colliding beams, 18: 16591 (BNL-7534(p.253-76))
Possible detection technique, 18: 16295 (BNL-7534(p.318-23))
Possible high-intensity, high-energy accelerator, 18: 16597 (BNL-7534 (p.385-91))
Proton storage in AGS, 18: 16589 (BNL-7534(p.230-5))
Radioactivity at high energies, 18: 16598 (BNL-7534(p.392-8))
Scattering at very high energies, 18: 16747 (BNL-7534(p.49-80))
Storage-ring work at Stanford, 18: 16587 (BNL-7534(p.209-27))
Storage rings, 18: 16590 (BNL-7534(p.236-7))
Strong-interaction theory studied at high energies, 18: 16748 (BNL-7534(p.81-2))
Studies on proton storage rings, 18: 16585 (BNL-7534(p.128-70))
Superconducting materials and possible applications, 18: 16602 (BNL-7534(p.417-47))
Use of large, heavy-liquid chamber at high-energy accelerators, 18: 16294 (BNL-7534(p.113-27))
Weak-interaction experiments with 1000-Bev accelerator, 18: 16750 (BNL-7534(p.88-106))

BRUSH BERYLLIUM CO., CLEVELAND.
Prog. rpt. on Be wire, 12/6/63–2/6/64, 18: 16451 (AD-432273)

BUREAU OF MINES. ANTHRACITE RESEARCH CENTER, SCHUYLKILL HAVEN, PENNA.
Effect of γ radiation on anthracite, 18: 16523 (BM-RI-6391)

BUTLER UNIV., INDIANAPOLIS. COLL. OF PHARMACY.
Light filter for reduction of background in liquid scintillation counting, 18: 16307 (TID-7689(p.31-3))

C

CALIFORNIA INST. OF TECH., PASADENA.
Coulomb-wave stripping amplitudes, 18: 16910 (ANL-6848(p.38-42))
Normal elliptic integrals of first and second kinds, 18: 17354 (IS-639)
Scattering at very high energies, 18: 16747 (BNL-7534(p.49-80))
Strong-interaction theory studied at high energies, 18: 16748 (BNL-7534(p.81-2))
X-ray scattering from single crystals, 18: 16551 (TID-20364)

CALIFORNIA OIL CO. SALT LAKE REFINERY, UTAH.
Radiotracer analysis of catalyst flow distribution, 18: 16390 (TID-7688 (p.84-90))

CALIFORNIA RESEARCH CORP., RICHMOND.
Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689(p.128-33))
Leak testing in refineries with radioisotopes, 18: 16389 (TID-7688 (p.80-3))
Radiotracer analysis of catalyst flow distribution, 18: 16390 (TID-7688 (p.84-90))
Residence time of particles in rotary kiln, 18: 16002 (TID-7689 (p.133-6))

CALIFORNIA. UNIV., BERKELEY.
Polarization of Ag nuclei in ferromagnets and magnet field, 18: 16954 (UCRL-11143)
Reactions (p,t), (p,He^3), and (p,α) on O-16, 18: 16936 (ANL-6848 (p.208-16))
Strongly populated levels of $(d_{5/2})^3$ and $(f_{7/2})^3$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))

CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Brain serotonin and behavior in rats, 18: 17364 (UCRL-11179)
Index of engineering notes and specifications, 18: 16160 (UCRL-11200(Vol.1))
Polarization of Ag nuclei in ferromagnets and magnet field, 18: 16954 (UCRL-11143)
Prog. rpt. on physics, semiannual, 5–10/63, 18: 16552 (UCRL-11132)

Reactions (p,t), (p,He³), and (p,α) on O-16, 18: 16936 (ANL-6848 (p.208-16))
Strongly populated levels of $(d_{5/2})^2$ and $(f_{7/2})^2$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))
Two-nucleon stripping reactions, 18: 16934 (ANL-6848(p.188-98))
Vapor pressure and heat of sublimation of BaF_2, 18: 16006 (UCRL-11124)
Vibrational structure of electronic band systems, 18: 16651 (UCRL-10925)

CALIFORNIA. UNIV., DAVIS.
Parity rule for inelastic scattering at small angles, 18: 16921 (ANL-6848(p.118-22))

CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Bibliography on refractory metal borides and nitrides, 18: 16481 (UCRL-7559)
Determination of O in organic compounds, 18: 15963 (UCRL-7618)
Engineering properties and applications of nuclear excavations, 18: 16162 (UCRL-7657)
Intensity limitations imposed by transverse space-charge effects in circular particle accelerators, 18: 16593 (BNL-7534(p.324-67))
Precision flying-spot film digitizer, 18: 16414 (UCRL-7619)
SOPHIST-5—code which calculates energy transfer for neutron scattering, 18: 16897 (UCRL-7624)
Thorium breeder reactor histories, 18: 17302 (UCRL-7544)
X-ray micrography of alpha Pu, 18: 16482 (UCRL-7651)

CANADA. DEPT. OF NATIONAL HEALTH AND WELFARE, OTTAWA.
Data from Radiation Protection Programs, Vol. 2, No. 2, 18: 16229 (NP-13760)

CARBORUNDUM CO., NIAGARA FALLS, N. Y.
Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)

CARNEGIE INST. OF TECH., PITTSBURGH.
Diffusion in B.C.C. metals, 18: 16474 (NP-13738)

CENTRE D'ÉTUDE DE L'ENERGIE NUCLEAIRE, MOL, BELGIUM.
Prog. rpt. on retreatment of irradiated fuels, 4–6/63, 18: 16130 (EURAEC-789)

CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN.
Critical heat flux and pressure drop measurements in round vertical tubes, 18: 16172 (EURAEC-951)
Fast multiplication factor in cylindrical symmetry, 18: 17282 (CEA-tr-X-319)
Heat transfer to steam–H_2O mixtures, 18: 16171 (EURAEC-929)
High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)

ČESKOSLOVENSKÁ AKADEMIE VĚD. ÚSTAV JADERNÉHO VÝZKUMU, REZ.
Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)

CHICAGO. UNIV.
Cosmic ray results at ultra-high energies, 18: 16728 (BNL-7534(p.2-28))
Diagnostic uses for Tc-99m, 18: 15913 (TID-7689(p.1-11))
Nuclear needle for neurosurgery, 18: 15912 (ACRH-20(p.25-36))
Percutaneous cordotomy for pain, 18: 15734 (ACRH-20(p.37-46))
Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689 (p.17-20))
Use of S^{35}-acetazolamide in blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))

CHICAGO. UNIV. ENRICO FERMI INST. FOR NUCLEAR STUDIES.
Experimental programs for 1000-Bev and 30-Bev accelerators, 18: 16584 (BNL-7534(p.39-48))

CLEVITE CORP. SHOCKLEY RESEARCH LAB., PALO ALTO, CALIF.
Preparation of Si for study of radiation damage, 18: 16528 (SC-DC-64-346)

COLUMBIA UNIV., IRVINGTON-ON-HUDSON, N. Y. NEVIS LABS.
Possible high-intensity, high-energy accelerator, 18: 16597 (BNL-7534 (p.385-91))

COLUMBIA UNIV., NEW YORK.
Alternative activity to storage rings—high-intensity AGS, 18: 16596 (BNL-7534(p.379-84))
Continuum radiation behind blast wave, 18: 16648 (NP-13739)

COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
Prog. rpt. on burnable poison additions to UO_2, 2/63, 18: 16468 (CEND-203)
Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)

CONNECTICUT. UNIV., NOANK. MARINE RESEARCH LAB.
Macroscopic benthic fauna off Cape Cod, 18: 17363 (TID-20363)

COPENHAGEN. UNIVERSITET.
Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))

CORNELL UNIV., ITHACA, N. Y.
Hydromagnetics of spherical conductor, 18: 16547 (AD-416626)
Prog. rpt. on solid-liquid interface, 6/6/63–6/5/64, 18: 16005 (TID-20354)

D

DANISH ASSN. FOR INDUSTRIAL DEVELOPMENT OF ATOMIC ENERGY, HELLERUP.
Dynamical behavior of GAMMA-II, 18: 17301 (NP-13499)

DEPARTMENT OF AGRICULTURE, BELTSVILLE, MD.
Silage density measured by γ attenuation, 18: 16393 (TID-7688 (p.106-13))

DEPARTMENT OF AGRICULTURE. SEDIMENTATION LAB., OXFORD, MISS.
Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))

DIVISION OF RESEARCH, AEC.
Summaries of research in physics and mathematics, 18: 16413 (TID-4005(Pts.3&4)(Rev.2))

DUKE UNIV., DURHAM, N. C.
Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
Neutron polarization and cross sections for $C^{13}(d,n)N^{15}$ reaction, 18: 16908 (ANL-6848(p.16-23))
Possible detection technique, 18: 16295 (BNL-7534(p.318-23))

E

EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA, CALIF.
Energy- and rate-dependence studies, 18: 16305 (NP-13748)

EUROPEAN ATOMIC ENERGY COMMUNITY.
Critical facility KRITO, 18: 17276 (EUR-498.e)
Determination of Al in SAP, 18: 15949 (EUR-585.i)
Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)
Measurement of large impulse currents in Cariddi experiment, 18: 17120 (RT/FI(63)-49)
Operation of BR-2 reactor, 3/31–4/21/63, 18: 17303 (NP-tr-1121)
Operation of BR-2 reactor, 4/21–5/12/63, 18: 17304 (NP-tr-1122)
Spatio-temporal diffusion equation in two-group approximation, 18: 16890 (EUR-596.e)
Subcritical facility PUK, 18: 17277 (EUR-499.e)

EUROPEAN ATOMIC ENERGY COMMUNITY. CENTRAL NUCLEAR MEASUREMENTS BUREAU, GEEL, BELGIUM.
Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-589.e)

EUROPEAN ATOMIC ENERGY COMMUNITY. EUROPEAN SCIENTIFIC DATA PROCESSING CENTER, ISPRA, ITALY.
Spatio-temporal diffusion equation in two-group approximation, 18: 16890 (EUR-596.e)

EUROPEAN ATOMIC ENERGY COMMUNITY. JOINT NUCLEAR RESEARCH CENTER, ISPRA, ITALY.
Determination of Al in SAP, 18: 15949 (EUR-585.i)
Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
Spatio-temporal diffusion equation in two-group approximation, 18: 16890 (EUR-596.e)

EUROPEAN NUCLEAR ENERGY AGENCY, PARIS.
Radioactive waste disposal into North Sea, 18: 17334 (NP-13756(Vol.I))
Radioactive waste disposal into North Sea, 18: 17335 (NP-13756(Vol.II))

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
Basic equations for Monte Carlo method, 18: 16410 (CERN-64-13 (Vol.I)(p.169-72))
Conference of 1964 CERN Easter school, Yugoslavia, 5/64, 18: 16606

(CERN-64-13(Vol.I))
Conference of 1964 CERN Easter School, Yugoslavia, 5/64, 18: 16607 (CERN-64-13(Vol.II))
Conference of 1964 CERN Easter school, Yugoslavia, 5/64, 18: 16608 (CERN-64-13(Vol.III))
Determination of Ξ decay parameters, 18: 16756 (CERN-64-13(Vol.II) (p.75-111))
Experimentation with colliding proton beams, 18: 16592 (BNL-7534 (p.277-307))
General alarm system, 18: 16605 (CERN-64-7)
Generating random numbers on computer, 18: 16411 (CERN-64-13 (Vol.I)(p.173-6))
Kinematical analysis of bubble chamber pictures, 18: 16296 (CERN-64-13(Vol.I)(p.87-129))
Lorentz transformations for general collision, 18: 16754 (CERN-64-13(Vol.I)(p.177-87))
Methods of spin determination of elementary particles and resonances, 18: 16757 (CERN-64-13(Vol.II)(p.113-92))
Notes on phase space, 18: 16755 (CERN-64-13(Vol.II)(p.1-73))
Statistics and application, 18: 16408 (CERN-64-13(Vol.I)(p.1-86))
Storage rings, 18: 16590 (BNL-7534(p.236-7))
Studies on proton storage rings, 18: 16585 (BNL-7534(p.128-70))
Theory of elemetary particles, 18: 16758 (CERN-64-13(Vol.III)(p.1-79))
Weak interactions of non-strange particles, 18: 16759 (CERN-64-13 (Vol.III)(p.81-110))

F

FIAT. SEZIONE ENERGIA NUCLEARE, TURIN.
Prog. rpt. on fission gas release from UO_2, 10–12/63, 18: 16524 (EURAEC-979)
Statistical methods for hot channel, 18: 17296 (EURAEC-910)
FISH AND WILDLIFE SERVICE. RADIOBIOLOGICAL LAB., BEAUFORT, N. C.
Radioisotopes in marine biological research, 18: 15748 (TID-7689 (p.69-72))
FOREST SERVICE, AIKEN, S. C.
Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, FONTENAY-AUX-ROSES.
Examination of irradiated Pu fuel elements, 18: 16163 (CEA-2395)
Fuel for Rapsodie, 18: 17290 (AEC-tr-6359)
FRANCE. COMMISSARIAT À L'ENERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, GRENOBLE.
Dispersed nuclear fuels with non-metallic fissile phase, 18: 17289 (CEA-Bib-41)
Dosage of H_2O_2 using uv spectrophotometry, 18: 15948 (CEA-2391)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Colliding beams to study intermediate boson, 18: 16752 (BNL-7534 (p.308-11))
Inelastic scattering of 44-Mev α particles in medium-weight nuclei, 18: 16925 (ANL-6848(p.137-42))
Operation of BR-2 reactor, 3/31–4/21/63, 18: 17303 (NP-tr-1121)
Operation of BR-2 reactor, 4/21–5/12/63, 18: 17304 (NP-tr-1122)
Zirconium alloys resistant to CO_2, 18: 16439 (CEA-2393)
FRANCE. SERVICE CENTRAL DE PROTECTION CONTRE LES RAYONNEMENTS IONISANTS, PARIS.
Prog. rpt., 12/63, 18: 16204 (SCPRI(RM)-XII-1963)
Radiochemical determination of Sr-90 in rain water, 18: 15958 (SCPRI(S)-81)
Rapid determination of I-131 in milk, 18: 15959 (SCPRI(S)-94)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Neutron and γ heating in Fe slabs, 18: 17243 (GAMD-3690)
Prog. rpt. on determination of O in K, 12/63, 18: 15951 (GA-4855)
Prog. rpt. on integral neutron thermalization, 12-63, 18: 16891 (GA-4881)
Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)
GENERAL DYNAMICS/ASTRONAUTICS, SAN DIEGO, CALIF.
Specialized toroidal pressure vessel, 18: 16164 (ERR-AN-174)
GENERAL ELECTRIC CO. ADVANCED TECHNOLOGY SERVICES, CINCINNATI.
Prog. rpt. on high-temperature materials, annual, 1/63–1/64, 18: 16424 (GEMP-270A)
GENERAL ELECTRIC CO. FLIGHT PROPULSION LAB. DEPT., IDAHO FALLS, IDAHO.
Prog. rpt. on Cr-base alloys, 12/15/62–3/15/63, 18: 16423 (GEMP-197)
GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Determination of the relative worth of Pu atoms, 18: 16736 (HW-79413)
Matrix treatment of general fissile interaction, 18: 16737 (HW-80213)
Mixed oxide fuel elements for PRTR, 18: 16452 (HW-79290)
Mixed oxide fuel elements for PRTR, 18: 16453 (HW-79291)
Plutonium Abstracts, Vol. 4, No. 1, 18: 17353 (HW-68600-35)
Plutonium nitride and refractory nitrides, 18: 16473 (HW-SA-3370)
PRCF experiments with H_2O moderator, 18: 17298 (HW-80092)
Production reactor testing facilities, 18: 17318 (HW-SA-3409)
Prog. rpt. on fixation of radioactive residues, 10–12/63, 18: 17332 (HW-80526)
Quarry blasting on Hanford reservation, 18: 17317 (HW-79614)
Replacement and improvement of fixed radiation monitoring instruments, 18: 16297 (HW-79027)
GENERAL ELECTRIC CO. MISSILE AND SPACE VEHICLE DEPT., BURLINGTON, VT.
Solvability of Bogoliubov kinetic theory for plasmas, 18: 17102 (AD-431025)
GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.
Prog. rpt. on pulsed neutron application to power reactor startup, 7–9/63, 18: 17297 (GEAP-4388)
GENERAL MOTORS CORP. RESEARCH LABS., WARREN, MICH.
Prog. rpt. on direct conversion of nuclear energy, 11/62–10/63, 18: 16740 (AD-425231)
GEOSCIENCE LTD., SOLANA BEACH, CALIF.
Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
Prog. rpt. on high acceleration field heat transfer for SNAP, 9–11/63, 18: 16177 (TID-20133)
GEOTECHNICAL CORP., GARLAND, TEX.
Seismic measurements of Clearwater, 18: 16189 (AD-427125(Rev.))
Seismic measurements of Stones, 18: 16191 (NP-13586(Rev.))
GERMANY. ZENTRALINSTITUT FUR KERNPHYSIK, DRESDEN.
Energy and energy distribution of cyclotron rays, 18: 16611 (ZFK-PHA-5)
f-Calculation with transport theory, 18: 16955 (ZFK-TPH-1)
Megawatt-hour meter for reactor heat energy, 18: 17261 (ZFK-RN-8)
S-wave-neutron strength function, 18: 16956 (ZFK-TPH-7)
Technology of isotope production. I., 18: 16401 (ZFK-RCH-1)
Theoretical study on zero reactor, 18: 17281 (ZFK-TPH-5)
GHENT. RIJKSUNIVERSITEIT.
Prog. rpt. on welding very thick steels, 7–9/63, 18: 16458 (EURAEC-811)
GT. BRIT. AGRICULTURAL RESEARCH COUNCIL. RADIOBIOLOGICAL LAB., WANTAGE, BERKS, ENGLAND.
Prog. rpt. on radiobiology, 1962–63, 18: 15735 (ARCRL-10)
GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE. RUTHERFORD HIGH ENERGY LAB., CHILTON, BERKS, ENGLAND.
Neutral cascade events from heavy liquid bubble chamber, 18: 16761 (NIRL/R/56)

H

HAHN-MEITNER-INSTITUT FUR KERNFORSCHUNG BERLIN.
Prog. rpt. on rare gas diffusion in solids, 10–12/63, 18: 16486 (EURAEC-969)
HALLIBURTON OIL WELL CEMENTING CO., DUNCAN, OKLA.
Fracturing information by use of radioisotopes, 18: 16194 (TID-7689 (p.105-18))

Uses of fluid tracers in oil wells, 18: 16192 (TID-7689(p.38-45))
HARRY DIAMOND LABS., WASHINGTON, D. C.
Radiation-induced cable currents. I., 18: 16522 (AD-429954)
HARVARD UNIV., BOSTON.
Foam suppression of radioactive iodine and particulates, 18: 16128 (NYO-9324)
HARVARD UNIV., CAMBRIDGE, MASS.
Dipole moments of excited electronic states of molecules, 18: 17352 (CONF-417-6)
HENRY FORD HOSPITAL, DETROIT.
Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
Tracer study of vacuum distillation and thin film deposition, 18: 16386 (TID-7688(p.40-3))
Use of isotopes in ring and linear vacuum distillation source studies, 18: 16000 (TID-7689(p.96-103))
HIGH VOLTAGE ENGINEERING CORP., BURLINGTON, MASS.
Activation analysis with Van de Graaff neutron sources, 18: 15956 (NP-13762)
Fast activation analysis with Van de Graaff neutron sources, 18: 15955 (NP-13761)
HONEYWELL RESEARCH CENTER, HOPKINS, MINN.
Mechanical behavior of MgO, 18: 16472 (HR-64-253)
Notch impact behavior of W, 18: 16475 (NP-13755)

I

ILLINOIS. UNIV., URBANA.
Experiments with neutron gas targets, 18: 16600 (BNL-7534(p.406-13))
Superconducting materials and possible applications, 18: 16602 (BNL-7534(p.417-47))
INDIANA UNIV., BLOOMINGTON.
Angular momentum selection and angular correlations in direct reactions with strongly absorbed particles, 18: 16927 (ANL-6848(p.147-52))
Inelastic scattering of α particles from C-12, Mg-24, Si-28 and Fe-56, 18: 16928(ANL-6848(p.153-8))
INDIANA UNIV., INDIANAPOLIS. MEDICAL CENTER.
Thyroidal and extrathyroidal hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Prog. rpt. on ecology of acantharia in relation to Sr in sea, 18: 15759 (TID-20366)
ISOTOPES, INC., WESTWOOD, N. J.
Prog. rpt. on high-altitude balloon sampling, 2/64, 18: 16203 (NYO-10496)
ISRAEL INST. OF TECH., HAIFA.
Microstructure of magnetic field in plasma, 18: 17104 (ARL-250(Pt.II))
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME.
Catalytic reduction of U(VI) by formic acid, 18: 15997 (RT/CHI(63)-32)
Construction of nuclear-propelled merchant ships, 18: 17321 (RTI/ING (63)-5)
Determination of alkali and alkaline earth metals, 18: 15957 (RT/PROT(63)-13)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE. LABORATORI NAZIONALI, FRASCATI.
Deflector for Adone, 18: 16610 (LNF-63/72)
Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)
Italian storage rings, 18: 16586 (BNL-7534(p.171-208))
Measurement of large impulse currents in Cariddi experiment, 18: 17120 (RT/FI(63)-49)
ITALY. ISTITUTO NAZIONALE DI FISICA NUCLEARE, TURIN.
Notes on the Monte Carlo method, 18: 16409 (CERN-64-13(Vol.I) (p.147-67))

J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Activities in Division of Health Physics, 4/62–3/63, 18: 16223 (JAERI-5012)
Production of P-32, S-35, and I-131, 18: 16398 (JAERI-4027)
JAPAN ATOMIC POWER CO., TOKYO.
Diffusion of gaseous waste dispersed from stacks in Tokai-Mura, 18: 16226 (NP-13687)

K

KANSAS STATE UNIV., MANHATTAN.
Using $C^{14}O_2$ for C fixation studies with pollen, 18: 15785 (TID-7689 (p.68-9))
KANSAS. UNIV., LAWRENCE.
Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))
Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
KERNFORSCHUNGSANLAGE, JÜLICH, GERMANY.
Applied magnetohydrodynamics. I., 18: 17107 (JÜL-145-TP)
Neutron measurements on paraffin pile, 18: 16892 (JUL-140-RX)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Compilation of standard cores. I., 18: 17279 (KAPL-M-JDJ-1)
FICS—program for few-group constants within KARE system, 18: 16893 (KAPL-M-6119)
Fission rate activation in thermal test reactor, 18: 17278 (KAPL-M-6101)
Reactivity coefficient of Al in PMA, 18: 16738 (KAPL-M-6121)
Stochastic models for heterogeneous materials. II., 18: 16647 (KAPL-M-CHR-7)

L

LAMAR STATE COLL. OF TECH., BEAUMONT, TEX.
Scintillation counting of I-129 and I-125, 18: 15961 (TID-7688(p.20-1))
LEAD DEVELOPMENT ASSN., LONDON.
Design and construction of lead-shielded containers. II., 18: 16227 (NP-13691)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Acute radiosensitivity as function of age in mice, 18: 15807 (LAMS-3034(p.112-15))
Aging in mice with different histories of ancestral x-ray exposure, 18: 15808 (LAMS-3034(p.116-23))
Breeding characteristics of offspring from mice with fifteen generations of x irradiation, 18: 15809 (LAMS-3034(p.124-8))
Cellular elements in peripheral blood of monkeys, 18: 15773 (LAMS-3034(p.96-102))
Cesium-137 body burdens of control subjects, 18: 16224 (LAMS-3034 (p.180-3))
Chromatography of nucleic acids, 18: 15780 (LAMS-3034(p.350-72))
Chromosome observations in nonirradiated progeny from irradiated RF males, 18: 15812 (LAMS-3034(p.303-6))
Chromosomes in transplanted leukemia of mice, 18: 15744 (LAMS-3034(p.307-11))
Comparison of neutron dose rates, 18: 16299 (LAMS-2977)
Computer programs for analyzing data, 18: 15737 (LAMS-3034(p. 168-79))
Distribution of Cs-137 in mice and dogs after chronic exposure, 18: 15766 (LAMS-3034(p.41-8))
Effect of ashing temperature on Cs and K content of bone, 18: 15953 (LAMS-3034(p.201-4))
Effect of exercise on excretion of Cs-137, 18: 15765 (LAMS-3034 (p.34-40))
Effect of temperature on retention of Sr in mice, 18: 15770 (LAMS-3034(p.65-72))
Electronic measurement of cellular volumes. IV., 18: 15739 (LAMS-3034(p.235-52))
Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))
Electronic measurement of cellular volumes. VI., 18: 15741 (LAMS-3034(p.261-9))
Electronic measurement of cellular volumes. VII., 18: 15742 (LAMS-3034(p.270-8))
Electronic measurement of cellular volumes. VIII., 18: 15743 (LAMS-3034(p.279-85))
Establishment of karyographic methods as tool in radiopathology, 18: 15738 (LAMS-3034(p.227-34))
Evaluation of K-40 continuum contribution to Cs-137 photopeak in spectrometer, 18: 16302 (LAMS-3034(pi162-7))
Extraction of lanthanons from electrolytes with Li amalgam, 18: 15945

(LADC-6084)
Hunco II status, 18: 16300 (LAMS-3034(p.143-51))
Inability of mouse to recognize γ radiations. I., 18: 15811 (LAMS-3034(p.133-40))
Low energy neutrino cross sections, 18: 16760 (LAMS-3013)
Metabolism of Mn-54, 18: 15767 (LAMS-3034(p.49-52))
Metabolism of radioiodine in children and adults, 18: 15775 (LAMS-3034(p.187-200))
Nucleic acids: automated base analysis, 18: 15954 (LAMS-3034 (p.313-18))
Oligonucleotide synthesis, 18: 15779 (LAMS-3034(p.329-49))
Potassium-40 and Cs-137 levels in beagles, 18: 15771 (LAMS-3034 (p.73-5))
Preparation of bacterial deoxyribonucleic acids, 18: 15776 (LAMS-3034(p.288-95))
Prog. rpt. on biological and medical research, annual, 7/62–6/63, 18: 15736 (LAMS-3034)
Purification of T-4 bacteriophage on DEAE cellulose columns for DNA isolation, 18: 15777 (LAMS-3034(p.296-302))
Radiation-induced irreparable biological damage in mice, 18: 15810 (LAMS-3034(p.129-32))
Representation of oligonucleotides, 18: 15745 (LAMS-3034(p.326-8))
Retention of Cs-137 by adults, 18: 15774 (LAMS-3034(p.184-6))
Retention of intravenously administered Cs-132, 18: 15764 (LAMS-3034(p.21-33))
Retention of intravenously administered Be-7 by rats, 18: 15769 (LAMS-3034(p.59-64))
Retention of Zr-95 in mice, 18: 15768 (LAMS-3034(p.53-8))
Solution calorimeter, 18: 16276 (LA-3031)
Theory of intermediate structure, 18: 16941 (ANL-6848(p.241-8))
Thermoluminescent dosimetry with activated LiF, 18: 16303 (LAMS-3034(p.205-23))
Ultracentrifugal sedimentation-velocity molecular weight data for DNA, 18: 15778 (LAMS-3034(p.319-25))
Volume and turnover of body water in monkeys, 18: 15772 (LAMS-3034(p.76-80))
Whole-body γ spectrometer for K and Cs-137, 18: 16301 (LAMS-3034 (p.152-61))

M

MARTIN-MARIETTA CORP. AEROSPACE DIV., BALTIMORE.
Handling and transportation tests of PM-1, 18: 17299 (MND-M-1915)
Prog. rpt. on biochemistry of senescence in plant cells, 6/63–3/64, 18: 17361 (TID-20353)
Radioisotope-powered underwater acoustic beacon, 18: 16397 (TID-7688(p.72-6))
Spent-fuel shipping cask, 18: 16225 (MND-M-1856)
MASCHINENFABRIK AUGSBURG-NURNBERG A. G., NUREMBERG.
Prog. rpt. on burnout in boiling water, 7–9/63, 18: 16184 (EURAEC-883)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Finite-range n-p potential in Coulomb stripping reactions, 18: 16911 (ANL-6848(p.43-50))
Isobaric analogue states and intermediate resonances in nuclei, 18: 16926 (ANL-6848(p.143-6))
Particle hole calculation of $Ca^{40}(\alpha,\alpha')$, 18: 16919 (ANL-6848(p.108-13))
Pion nuclear elastic charge-exchange scattering, 18: 16939 (ANL-6848 (p.236-9))
Prog. rpt. on fallout prediction, 3–5/63, 18: 16202 (AD-416645)
Prog. rpt. on neutron physics, 1–12/63, 18: 16894 (MIT-3031-1)
Prog. rpt. on thermodynamic studies of complex ions, 9/15/64–9/14/64, 18: 17355 (MIT-1965-7)
Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))
Use of large, heavy-liquid chamber at high-energy accelerators, 18: 16294 (BNL-7534(p.113-27))
MAX-PLANCK-INSTITUT FÜR KERNPHYSIK, HEIDELBERG.
Deuteron-γ angular correlation in $Mg^{24}(d,d'\gamma)$, 18: 16922 (ANL-6848 (p.123-4))
MAX-PLANCK-INSTITUT FUR METALLFORSCHUNG, STUTTGART.
Strengthening of neutron-irradiated single crystals of Cu. I., 18: 16530 (AEC-tr-6373)
MELLON INST., PITTSBURGH.
Pulmonary deposition and retention of inhaled aerosols, 18: 15806
MERCK SHARP AND DOHME RESEARCH LABS., RAHWAY, N. J.
Residue studies with radioisotopic drugs, 18: 15784 (TID-7689 (p.58-62))
MHD RESEARCH, INC., NEWPORT BEACH, CALIF.
Physics of pulsed MHD generators, 18: 16743 (MHD-646)
MICHIGAN. UNIV., ANN ARBOR.
Can cosmic rays replace accelerators?, 18: 16729 (BNL-7534(p.29-38))
Comments on colliding beams, 18: 16753 (BNL-7534(p.312-17))
p-p Elastic scattering with colliding beams, 18: 16751 (BNL-7534 (p.238-52))
Physics with colliding beams, 18: 16591 (BNL-7534(p.253-76))
Radiotracers for leak detection in Saturn vehicle, 18: 16392 (TID-7688 (p.95-7))
Rotating disk electrode, 18: 16004 (TID-20339)
MIDWESTERN UNIVERSITIES RESEARCH ASSN., STOUGHTON, WIS.
Coherent vertical instabilities in MURA 50-Mev electron accelerator, 18: 16594 (BNL-7534(p.368-74))
Magnetic field shaping by superconducting surfaces, 18: 16604 (BNL-7534(p.449-77))
MINNESOTA. UNIV., MINNEAPOLIS.
Elastic and inelastic scattering of 40-Mev protons, 18: 16924 (ANL-6848(p.130-6))
Prog. rpt. on two-phase flow, 3/9/64, 18: 16178 (TID-20336)
MISSISSIPPI. UNIV., JACKSON. MEDICAL CENTER.
Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
MONSANTO CHEMICAL CO., TEXAS CITY, TEX.
Process gas flow rate measurements with Xe-133, 18: 16387 (TID-7688 (p.76-8))
MOUND LAB., MIAMISBURG, OHIO.
Prog. rpt., 5/63, 18: 16376 (MLM-1157)
MUNICH. TECHNISCHE HOCHSCHULE.
Saturation phenomena of defect production by irradiation at low temperature, 18: 16531 (AI-Trans-38)

N

NAGOYA, JAPAN. UNIV.
Unified theory of relaxations in plasmas, 18: 17106 (IPPJ-17)
NATIONAL ACADEMY OF SCIENCES.
Compilation of U. S. IGY-IGC rocket program results, 18: 16580
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Effects of Cs vapor on ionization gages, 18: 16277 (NASA-TN-D-2264)
NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Electrons transmitted through Al_2O_3 foils, 18: 17244 (NASA-SP-3008)
Melting points of metal oxides, 18: 15996 (NBS-MON-68)
Methods of evaluating radiological equipment and materials, 18: 16279 (NP-13746)
NATIONAL CARBON CO., LAWRENCEBURG, TENN.
Young's modulus of graphite at elevated temperatures, 18: 16186 (WADD-TR-61-72(Vol.XXIII))
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Prog. rpt. on environmental monitoring in vicinity of FMPC, 2/64, 18: 16233 (TID-20368)
NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Effect of age on radiation-induced polydipsia in rat, 18: 15815 (USNRDL-TR-712)
Effect of radionuclide fractionation on exposure dose rate from local fallout, 18: 16234 (USNRDL-TR-715)
Response of insect eye to β radiation, 18: 15814 (USNRDL-TR-698)
Response of portable radiation instruments, 18: 16309 (USNRDL-TR-701)
Soil-moisture prediction method for induced-activity prediction system, 18: 16206 (USNRDL-TR-662)
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Prog. rpt. on irradiation effects on structural materials, 11/62–1/63, 18: 16527 (NRL-Memo-1393)
NERATOOM, N. V., THE HAGUE.
Prog. rpt. on making pressure containers, 10–12/63, 18: 16459 (EURAEC-962)
NETHERLANDS. KONINKLIJK NEDERLANDSCH METEOROLOGISCH IN-

STITUT, DE BILT.
Graphs for determination of plume rise, 18: 16235 (AEC-tr-6365)
NETHERLANDS. NIJVERHEIDSORGANISATIE, TNO, THE HAGUE.
Prog. rpt. on determination of ductile-brittle transition temperature, 10–12/63, 18: 16470 (EURAEC-913)
NEW HAMPSHIRE. UNIV., DURHAM.
Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))
NEW MEXICO. UNIV., ALBUQUERQUE.
Transient response of linear undamped and lightly damped lumped spring-mass systems, 18: 17360 (TID-18775)
NEW YORK SHIPBUILDING CORP., CAMDEN, N. J.
Radiochemistry during startup and operation of *Savannah*, 18: 17320 (NSEC-72)
NEW YORK UNIV., NEW YORK.
Measurement of diffusivity in high viscosity liquid, 18: 15998 (TID-7688(p.52-63))
Prog. rpt. on low density plasmas, annual, 18: 17121 (TID-20362)
NORTH CAROLINA STATE COLL., RALEIGH.
Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848(p.226))
Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))
NORTH CAROLINA. UNIV., CHAPEL HILL.
Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848(p.226))
NUCLEAR METALS, INC., WEST CONCORD, MASS.
Fine-grained U by shot addition during casting, 18: 16454 (NMI-7019)
NUCLEAR SCIENCE AND ENGINEERING CORP., PITTSBURGH.
Radiochemistry during startup and operation of *Savannah*, 18: 17320 (NSEC-72)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Fixed filter paper α air monitor, 18: 16298 (K-1589)
Vapor-liquid equilibrium of the UF_6–decafluorobis-(trifluoromethyl) cyclohexane, C_8F_{16}, system, 18: 15995 (K-271)
OAK RIDGE INST. OF NUCLEAR STUDIES, INC., TENN.
Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689(p.128-33))
Alpha gage system for measurement of gas density, gas pressure, and thin film thickness, 18: 16383 (TID-7688(p.7-13))
Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
Biological behavior of Cs-137, 18: 15783 (TID-7689(p.55-8))
Conference on radioisotopes, second annual, Oak Ridge, 4/64, 18: 16378 (TID-7689)
Conference radioisotope applications, Oak Ridge, 4/63, 18: 16382 (TID-7688)
Diagnostic uses for Tc-99m, 18: 15913 (TID-7689(p.1-11))
Digital and analog methods for radioisotope measurement, 18: 15917 (TID-7689(p.25-8))
Evaluation of I-125 measurement techniques for clinical applications, 18: 15915 (TID-7689(p.15-16))
Finite-range n-p potential in Coulomb stripping reactions, 18: 16911 (ANL-6848(p.43-50))
Fracturing information by use of radioisotopes, 18: 16194 (TID-7689 (p.105-18))
Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))
Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))
Light filter for reduction of background in liquid scintillation counting, 18: 16307 (TID-7689(p.31-3))
Maximum allowable radiotracer injections for flow rate measurements in public streams, 18: 15905 (TID-7689(p.34-7))
Methylene blue dye adsorption on siliceous minerals, 18: 16193 (TID-7689(p.85-6))
Potentials of isotopic radiography, 18: 15918 (TID-7689(p.29-30))
Radioisotope-powered underwater acoustic beacon, 18: 16397 (TID-7689(p.72-6))
Radioisotopes in marine biological research, 18: 15748 (TID-7689 (p.69-72))
Radioisotopes in alkaline-earth analysis, 18: 15962 (TID-7689(p.81-5))
Radiotracer technique for determining stream flow rates, 18: 16391 (TID-7688(p.91-4))
Rapid screening method for detecting abnormal plasma vitamin B_{12}, 18: 15914 (TID-7689(p.11-14))
Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
Residence time of particles in rotary kiln, 18: 16002 (TID-7689 (p.133-6))
Residue studies with radioisotopic drugs, 18: 15784 (TID-7689 (p.58-62))
Scintillator for neutron detection, 18: 16308 (TID-7689(p.103-5))
Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
Surface self-diffusion of adsorbed atoms, 18: 16479 (TID-7689(p.86-9))
Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
Thyroidal and extrathyroidal hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))
Tracer studies of impurity-doped oxide cathodes, 18: 16003 (TID-7689 (p.136-7))
Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689 (p.17-20))
Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
Use of isotopes in ring and linear vacuum distillation source studies, 18: 16000 (TID-7689(p.96-103))
Use of S^{35}-acetazolamide in blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))
Uses of fluid tracers in oil wells, 18: 16192 (TID-7689(p.38-45))
Using $C^{14}O_2$ for C fixation studies with pollen, 18: 15785 (TID-7689 (p.68-9))
Using γ transmission to determine shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))
Wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))
OAK RIDGE NATIONAL LAB., TENN.
Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689(p.128-33))
Analysis of $Zr^{96}(d,p)Zr^{97}$ stripping reaction, 18: 16909 (ANL-6848(p.30-7))
Angular and spectral distributions of light emitted from electron-bombarded Ag foils, 18: 16649 (ORNL-3485)
Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
Biological behavior of Cs-137, 18: 15783 (TID-7689(p.55-8))
Cataloging rules and practice of ORNL Library, 18: 17356 (ORNL-TM-579)
Conference on radioisotopes, second annual, Oak Ridge, 4/64, 18: 16378 (TID-7689)
Conference radioisotope applications, Oak Ridge, 4/63, 18: 16382 (TID-7688)
Diagnostic uses for Tc-99m, 18: 15913 (TID-7689(p.1-11))
Digital and analog methods for radioisotope measurement, 18: 15917 (TID-7689(p.25-8))
Elastic scattering of 17-Mev protons from heavy nuclei, 18: 16920 (ANL-6848(p.114-17))
Evaluation of I-125 measurement techniques for clinical applications, 18: 15915 (TID-7689(p.15-16))
Fracturing information by use of radioisotopes, 18: 16194 (TID-7689 (p.105-18))
Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))
HRE-2 design report, 18: 17326 (ORNL-TM-348)
Instantaneous collapse and creep buckling of shells, 18: 16159 (ORNL-3555)
Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))

Light filter for reduction of background in liquid scintillation counting, 18: 16307 (TID-7689(p.31-3))
Maximum allowable radiotracer injections for flow rate measurements in public streams, 18: 15905 (TID-7689(p.34-7))
Methylene blue dye adsorption on siliceous minerals, 18: 16193 (TID-7689(p.85-6))
Monoclinic-cubic transformation in ThC_2, 18: 16477 (ORNL-3588)
Nucleon capture reactions near A = 40, 18: 16931 (ANL-6848(p.177))
Oak Ridge National Laboratory 86-in. cyclotron program, 18: 16399 (TID-7688(p.5-7))
Potentials of isotopic radiography, 18: 15918 (TID-7689(p.29-30))
Prestressing two-layer pressure vessel, 18: 17260 (ORNL-3546(Suppl.1))
Prog. rpt. on fission products, 10–11/62, 18: 16377 (ORNL-TM-515)
Prog. rpt. on removal of metallic ions by foaming agents, 7/62–6/63, 18: 16129 (RAI-116)
Radioisotope-powered underwater acoustic beacon, 18: 16397 (TID-7689(p.72-6))
Radioisotopes in marine biological research, 18: 15748 (TID-7689 (p.69-72))
Radioisotopes in alkaline-earth analysis, 18: 15962 (TID-7689(p.81-5))
Rapid screening method for detecting abnormal plasma vitamin B_{12}, 18: 15914 (TID-7689(p.11-14))
Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
Removing radioiodine from hot-off gas systems, 18: 16230 (TID-7688 (p.68-74))
Residence time of particles in rotary kiln, 18: 16002 (TID-7689 (p.133-6))
Residue studies with radioisotopic drugs, 18: 15784 (TID-7689 (p.58-62))
Scattering of protons by Ho-165, 18: 16940 (ANL-6848(p.24-9))
Scintillator for neutron detection, 18: 16308 (TID-7689(p.103-5))
Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
Surface self-diffusion of adsorbed atoms, 18: 16489(p.86-9))
Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
Thorium–uranium-235 oxide facility, 18: 16455 (ORNL-3539)
Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
Thyroidal and extrathyroidal hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))
Tracer studies of impurity-doped oxide cathodes, 18: 16003 (TID-7689 (p.136-7))
Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689 (p.17-20))
Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
Use of isotopes in ring and linear vacuum distillation source studies, 18: 16000 (TID-7689(p.96-103))
Use of S^{35}-acetazolamide in blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))
Uses of fluid tracers in oil wells, 18: 16192 (TID-7689(p.38-45))
Using $C^{14}O_2$ for C fixation studies with pollen, 18: 15785 (TID-7689 (p.68-9))
Using γ transmission to determine shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))
Wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))

OHIO STATE UNIV., COLUMBUS.
Potentials of isotopic radiography, 18: 15918 (TID-7689(p.29-30))
OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
Prog. rpt. on effects of insecticide on ecology of fauna, 12/60–11/63, 18: 17362 (TID-20355)
OKLAHOMA. UNIV., NORMAN.
Diffusion phenomena in liquid Cd–Pb binary system, 18: 16480 (TID-20326)
OSLO. UNIVERSITET, BLINDERN. FYSISK INSTITUTT.
Notes on phase space, 18: 16755 (CERN-64-13(Vol.II)(p.1-73))
OSTERREICHISCHE STUDIENGESELLSCHAFT FUR ATOMENERGIE G.M.B.H., VIENNA.
Analysis of irradiated and unirradiated fuel samples, 18: 15960 (SGAE-PH/CH-1/1964)
Electromagnetic mass separation for cross section measurements, 18: 16950 (SGAE-PH-2/1964)
Resolution correction for magnetic β spectrometer, 18: 16306 (SGAE-PH-3/1964)
OXFORD UNIV.
Reaction $U^{238}(d,p)U^{239}$, 18: 16912 (ANL-6848(p.52-62))
Stripping and pickup reactions on C-12, C-13, and C-14, 18: 16914 (ANL-6848(p.70-8))

P

PADUA. UNIVERSITÀ
Theory of elementary particles, 18: 16758 (CERN-64-13(Vol.III)(p.1-79))
PARAMETRICS, INC., WALTHAM, MASS.
Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
PARIS. ECOLE POLYTECHNIQUE.
Statistics and application, 18: 16408 (CERN-64-13(Vol.I)(p.1-86))
PARIS. UNIVERSITÉ.
Application of polymerization to radiation chemistry, 18: 16077 (NP-13734)
Isotope effect on H bonds, 18: 16066 (NP-13736)
Lepton decays of Λ^0 and Σ^-, 18: 16764 (NP-13731)
Quadrupolar deformations of heavy nuclei, 18: 16949 (NP-13735)
Radioinduced modifications to lipids, 18: 15813 (NP-13733)
Reaction $C^{13}(He^3,\alpha)C^{12}$ between 1 and 2 Mev, 18: 16948 (NP-13732)
PARIS. UNIVERSITÉ, ORSAY.
Microstructure of magnetic field in plasma, 18: 17104 (ARL-250(Pt.II))
Scattering of high-energy electrons in Al-27, 18: 16944 (LAL-1091)
Storage ring for electrons and positrons, 18: 16609 (LAL-1081)
PARMA, ITALY. UNIVERSITÀ.
Prog. rpt. on radioactivity in marine environment, 1963, 18: 15758 (TID-20347)
PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Doppler broadening of total neutron cross sections of Pu-241, 18: 16942 (IDO-16954)
Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
PICATINNY ARSENAL, DOVER, N. J.
Adsorption isotherm of surfactant on organic substrate, 18: 16384 (TID-7688(p.31-7))
PITTSBURGH. UNIV.
Pulmonary deposition and retention of inhaled aerosols, 18: 15806
POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH, SWIERK.
Computer for reactor calculations, 18: 17250 (PAN-O-117)
POONA. UNIV.
Surface self-diffusion of adsorbed atoms, 18: 16479 (TID-7689(p.86-9))
PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP., HARTFORD, CONN.
Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
PRINCETON UNIV., N. J.
Excitation of $T = T_z + 2$ states, 18: 16923 (ANL-6848(p.125-9))
Experimental results from Stanford electron storage ring, 18: 16595 (BNL-7534(p.375-8))
Selection rules in $Ti^{46}(p,p^*)$ inelastic scattering, 18: 16930 (ANL-6848 (p.168-71))
Storage-ring work at Stanford, 18: 16587 (BNL-7534(p.209-27))
PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
Radionuclide analysis of γ spectra, 18: 16353

R

RADIATION APPLICATIONS INC., LONG ISLAND CITY, N. Y.
Prog. rpt. on removal of metallic ions by foaming agents, 7/62–6/63, 18: 16129 (RAI-116)
RADIO CORP. OF AMERICA. TELEVISION PICTURE TUBE DIV., MARION, IND.
Tracer studies of impurity-doped oxide cathodes, 18: 16003 (TID-7689

(p.136-7))
REACTOR CENTRUM NEDERLAND, PETTEN.
Critical facility KRITO, 18: 17276 (EUR-498.e)
Subcritical facility PUK, 18: 17277 (EUR-499.e)
RESEARCH TRIANGLE INST., DURHAM, N. C.
Maximum allowable radiotracer injections for flow rate measurements in public streams, 18: 15905 (TID-7689(p.34-7))
RICE UNIV., HOUSTON, TEX.
Analysis of $Cr^{52}(d,p)Cr^{53}$ reaction, 18: 16913 (ANL-6848(p.63-9))
Reactions (He^3,n), 18: 16935 (ANL-6848(p.199-207))
ROCHESTER, N. Y. UNIV.
Reactions $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3,He^3')O^{16}$, 18: 16907 (ANL-6848 (p.8-15))
RUTGERS UNIV., NEW BRUNSWICK, N. J.
Direct reaction contributions to fluctuating reaction cross sections, 18: 16938 (ANL-6848(p.228-9))
Mean flow characteristics of gas-solid suspensions, 18: 16176 (NYO-2930-1)
Singlet di-nucleon state in nuclear reactions, 18: 16932 (ANL-6848 (p.180-1))

S

SANDIA CORP., ALBUQUERQUE, N. MEX.
Airborne vibration analysis system, 18: 16280 (SC-TM-328-62(72))
Performing human-factors reliability analysis, 18: 17358 (SC-R-685)
Preparation of Si for study of radiation damage, 18: 16528 (SC-DC-64-346)
Process start and control procedures, 18: 17357 (SC-DC-64-378)
Transient response of linear undamped and lightly damped lumped spring-mass systems, 18: 17360 (TID-18775)
SANDIA CORP. LIVERMORE LAB., LIVERMORE, CALIF.
Inertial load on plate under blast loading, 18: 17359 (SCL-TM-64-34)
SANDIA LAB., ALBUQUERQUE, N. MEX.
Construction of sea level, transisthmian canal using nuclear explosives, 18: 16161 (SC-4929(RR))
SHELL DEVELOPMENT CO., HOUSTON, TEX.
Methylene blue dye adsorption on siliceous minerals, 18: 16193 (TID-7689(p.85-6))
SOCIÉTÉ ANONYME DES FORGES ET ATELIERS DU CREUSOT, LE CREUSOT, FRANCE.
Prog. rpt. on joints welded on high-resistance steel, 7–9/63, 18: 16485 (EURAEC-829)
SOCIETE D'ETUDES, DE RECHERCHES ET D'APPLICATIONS POUR L'INDUSTRIE, BRUSSELS.
Prog. rpt. on steel corrosion in water and steam, 10–12/63, 18: 16442 (EURAEC-960)
SOCIÉTÉ NATIONALE D'ÉTUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION, SURESNES, FRANCE.
Influence of whorls induced in boiling water on critical flows, 18: 16183 (EURAEC-639)
Two-phase air water flows on SENN type assembly fraction with and without twist strips, 18: 16182 (EURAEC-638)
Use of twisted tapes in boiling water reactors, 18: 17251 (EURAEC-931)
SOUDOMETAL, S. A., BRUSSELS.
Prog. rpt. on welding very thick steels, 7–9/63, 18: 16458 (EURAEC-811)
SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
Prog. rpt. on properties of TZM Mo alloy sheet and W sheet, 5–7/63, 18: 16476 (NP-13759)
STANFORD RESEARCH INST., MENLO PARK, CALIF.
Local seismic monitoring at Shoal, 18: 16190 (NP-13757)
SWEDEN. FÖRSVARETS FORSKNINGSANSTALT, STOCKHOLM.
Backscattering of fast neutrons from plane and spherical reflectors, 18: 16896 (NP-13720)
SWITZERLAND. EIDGENOSSISCHES INSTITUT FÜR REAKTORFORSCHUNG, WÜRENLINGEN.
Penetration of thermal neutrons in empty cylindrical channels through hydrogeneous media, 18: 17249 (EIR-60)
SYDNEY. UNIV.
Production of highly excited neutral atoms for injection into plasma devices, 18: 17118 (NP-13744)
Prog. rpt. on plasma physics, 7–12/63, 18: 17117 (NP-13743)

T

TAYLOR UNIV., UPLAND, IND.
Diffusion of radioactive gases through films, 18: 16550 (TID-7688 (p.64-7))
TEXAS. AGRICULTURAL AND MECHANICAL UNIV., COLLEGE STATION.
Neutron reduced widths by $N^{14}(N^{14},N^{13})N^{15}$ transfer reaction, 18: 16929 (ANL-6848(p.160-7))
TEXAS INSTRUMENTS INC., DALLAS.
Application of radiochemistry to semiconductor research, 18: 16385 (TID-7688(p.38-40))
TEXAS. UNIV., AUSTIN.
Plasma diagnostic methods for high-temperature plasma research, 18: 17103 (ARL-64-6)
THOMPSON RAMO WOOLDRIDGE INC. TRW ELECTROMECHANICAL DIV., CLEVELAND.
Prog. rpt. on solar thermionic generators, 11/63–1/64, 18: 16744 (TRW-ER-5802)
SNAP-2 rotational speed control, 18: 17319 (NAA-SR-6310)
TURKEY. ATOMIC ENERGY COMMISSION. ÇEKMECE NUCLEAR RESEARCH CENTER, ISTANBUL.
Algebraic structure of cluster expansions in statistical mechanics, 18: 16412 (CNAEM-14)

U

U.S.S.R. SOVET MINISTROV. GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOĬ ENERGII.
Apparatus for measuring angular distribution of annihilation radiation of positrons, 18: 16304 (NP-13693)
Changes in properties of meat by irradiation, 18: 16381 (NP-13619)
Characteristics of "Tokomak-III," 18: 17111 (NP-13696)
Control apparatus and shielding of fast pulsed reactor, 18: 17325 (NP-13710)
Efficiency of system of absorber-type rods, 18: 17259 (NP-13659)
Excitation of oscillations by electron beam in plasma, 18: 17112 (NP-13697)
Gas-discharge pulse apparatus for testing plasma diagnostic equipment, 18: 17114 (NP-13705)
Group constants of fast and intermediate neutrons for designing reactors, 18: 17287 (NP-13666)
Group cross sections of nuclear reactions used for recording neutrons, 18: 16947 (NP-13661)
Heat exchange in liquid metals in pipes, 18: 16174 (NP-13660)
Heat exchange in transverse flow around tube bundles, 18: 16175 (NP-13712)
Heat transfer in liquid metals flowing through pipes, 18: 16173 (NP-13656)
High-frequency oscillations of plasma in magnetic field, 18: 17109 (NP-13612)
Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
Optimum parameters of GVL-2 magnetic system, 18: 17116 (NP-13711)
Polarization of cosmic muons and determination of ratio $K^+/K^+ + \pi^+$, 18: 16762 (NP-13694)
Theory of resonance absorption of neutrons in media, 18: 16895 (NP-13662)
UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.
Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
Calculation for heterogeneous fast reactors, 18: 17275 (AEEW-R-183)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Diagram expressions useful in theory of fluids, 18: 16548 (AERE-R-4494)
Fine-grained graphites for nuclear applications, 18: 16465 (AERE-

R-3943)
Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Electric, magnetic, and seismo-electric signals from nuclear explosions, 18: 16546 (AWRE-O-87/63)
Reaction $U^{238}(d,p)U^{239}$, 18: 16912 (ANL-6848(p.52-62))
Reactions $Mg^{24}(d,p)Mg^{25}$ and $Mg^{26}(t,d)Mg^{25}$, 18: 16918 (ANL-6848(p.104-5))
Stripping and pickup reactions on C-12, C-13, and C-14, 18: 16914 (ANL-6848(p.70-8))

UNITED NUCLEAR CORP. DEVELOPMENT DIV., WHITE PLAINS, N. Y.
Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)
Using γ transmission to determine shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))

UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Critical heat flux and pressure drop measurements in round vertical tubes, 18: 16172 (EURAEC-951)
Etch-pit observations concerning twins in Fe and Fe alloys, 18: 16471 (EURAEC-978)
Heat transfer to steam–H_2O mixtures, 18: 16171 (EURAEC-929)
High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)
Influence of whorls induced in boiling water on critical flows, 18: 16183 (EURAEC-639)
Prog. rpt. on burnable poison additions to UO_2, 2/63, 18: 16468 (CEND-203)
Prog. rpt. on burnout in boiling water, 7–9/63, 18: 16184 (EURAEC-883)
Prog. rpt. on determination of ductile-brittle transition temperature, 10–12/63, 18: 16470 (EURAEC-913)
Prog. rpt. on diffusion and precipitation of hydrogen in Zr, 6–9/63, 18: 16469 (EURAEC-821)
Prog. rpt. on fission gas release from UO_2, 10–12/63, 18: 16524 (EURAEC-979)
Prog. rpt. on making pressure containers, 10–12/63, 18: 16459 (EURAEC-962)
Prog. rpt. on rare gas diffusion in solids, 10–12/63, 18: 16486 (EURAEC-969)
Prog. rpt. on retreatment of irradiated fuels, 4–6/63, 18: 16130 (EURAEC-789)
Prog. rpt. on steel corrosion in water and steam, 10–12/63, 18: 16442 (EURAEC-960)
Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)
Prog. rpt. on welding very thick steels, 7–9/63, 18: 16458 (EURAEC-811)
Statistical methods for hot channel, 18: 17296 (EURAEC-910)
Two-phase air water flows on SENN type assembly fraction with and without twist strips, 18: 16182 (EURAEC-638)
Use of twisted tapes in boiling water reactors, 18: 17251 (EURAEC-931)

UNIVERSAL-CYCLOPS STEEL CORP., BRIDGEVILLE, PENNA.
Prog. rpt. on welding refractory metals, 10–12/63, 18: 16450 (AD-431672)

V

VANDERBILT UNIV., NASHVILLE.
Biological behavior of Cs-137, 18: 15783 (TID-7689(p.55-8))
Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)

VETERANS ADMINISTRATION HOSPITAL, BLOOMINGTON, IND.
Thyroidal and extrathyroidal hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))

VETERANS ADMINISTRATION HOSPITAL, FORT HOWARD, MD.
Digital and analog methods for radioisotope measurement, 18: 15917 (TID-7689(p.25-8))

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
Wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))

W

WASHINGTON. UNIV., SEATTLE. COLL. OF ENGINEERING.
Prog. rpt. on cyclotron research, annual, 1963, 18: 16951 (TID-20311)
Validity of WKB approximation for high-energy distorted wave calculations, 18: 16906 (ANL-6848(p.2-7))

WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
Bibliography of analytical methods for alkali metals, 18: 15964 (WCAP-2540)
Design and cost estimate for Na pump test facility, 18: 16166 (WCAP-2526)
High-temperature supercritical-pressure water loop, 18: 16441 (WCAP-2056(Pt.I))
Supercritical pressure water loop. II., 18: 16179 (WCAP-2056(Pt.II))
TURBO*—two-dimensional depletion code, 18: 17280 (WCAP-6059)

WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Corrosion and H absorption of Zy-2, 18: 16440 (WAPD-283)
Fabrication of B_4C and B_4C + SiC mixtures, 18: 16427 (WAPD-244)

WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH.
Stimulated emission of γ radiation, 18: 16952 (TID-20313)

WISCONSIN. UNIV., MADISON.
High-energy physics with large heavy-liquid bubble chamber, 18: 16293 (BNL-7534(p.107-12))

Y

YALE UNIV., NEW HAVEN.
Mobility of Li^+ in He, 18: 15994 (AD-416506)
Prog. rpt. on nucleon-nucleon interaction, annual, 2/64, 18: 16953 (TID-20352)
Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

æ	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

A

ABAGYAN, L. P., Group constants of fast and intermediate neutrons for designing reactors, 18: 17287 (NP-13666)

ABBATI, A., Radiation effects on pleural exudation, 18: 15877

ABDULLAEV, V. M., Glycogen in eyeball tissue in radiation sickness, 18: 15837

ABE, R., Calculating density matrix based on path integrals, 18: 16652 (UCRL-Trans-1026(L))

ABE, Ryuzo, Calculating density matrix based on path integrals, 18: 16652 (UCRL-Trans-1026(L))

ABECASIS, Sara M., Separation of Sb from irradiated enriched Te, 18: 16149

ABLYAEV, Sh. A., Effects of h-f discharge on adsorption properties of silica gels and zeolites, 18: 16117

ABLYAEV, Sh. A., Effects of γ radiation on adsorptive properties of synthetic zeolites, 18: 16118

ABOU-LEILA, A., Lifetime of first excited level of Gd-152, 18: 16986

ABOU-LEILA, H., Disintegration Pa-231 → Ac-227, 18: 16985

ABRAMOV, A. I., Cross sections of inelastic neutron collisions with Fe, Ni and Nb nuclei, 18: 16958 (NP-tr-1114)

ACHARI, R., Angular correlations in (d,p) stripping reactions on Be-9 and Ca-40, 18: 16993

ACKERS, J. G., Critical facility KRITO, 18: 17276 (EUR-498.e)

ADAMS, N., Derivation of absorbed tissue doses, 18: 16263

ADAMS, Ralph N., Nuclear hyperfine coupling constants in EPR spectra, 18: 16068

ADEMA, Jacobo, Dark reactivation of uv-irradiated bacteriophage DNA, 18: 15832

ADITYA, Prem K., Multiple Coulomb scattering for very-high energy particles, 18: 17062

ADLER, G., Birefringence in irradiated polyethylene, 18: 16098

ADLER, Howard I., Sensitivity to radiation in *E. coli*, 18: 15846

ADORNI, N., High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)

AFROSIMOV, V. V., Energy losses in single collisions of atomic particles, 18: 16710

AGASYAN, E. O., Amplitude converter with logarithmic characteristics, 18: 16341

AGENA, H. H., Prog. rpt. on burnout in boiling water, 7–9/63, 18: 16184 (EURAEC-883)

AGY, V., Effects of magnetic disturbance on ionosphere, 18: 16837

AIZU, Ko, Field operators for bosons with impenetrable cores. II., 18: 16804

AKASOFU, S. I., Lower limit of latitude of northern quiet auroral arcs, 18: 16821

AKASOFU, Syun-Ichi, Auroral rays, 18: 16820

AKCHURIN, R. Sh., Superconducting magnet with inductive excitation, 18: 16880

AKHIEZER, I. A., Interaction between particles and waves with plasma, 18: 17157

AKHMEDOV, S. Sh., Superconducting magnet with inductive excitation, 18: 16880

AKI, Keiiti, Surface waves from the hardhat nuclear explosion, 18: 16197

AKIYOSHI, Ts., Fission of Th-232 induced by He ions, 18: 17067

ALBERT, D., Conception of neutron density, flux, and temperature, 18: 16903

ALBERT, Philippe, Chemical activity of H desorbed from Pd, 18: 17368 (AI-Trans-37)

ALCOBER, Vicente, Effects of heavy high-energy charged particles. II., 18: 15827

ALCOCK, M. W., Electric, magnetic, and seismo-electric signals from nuclear explosions, 18: 16546 (AWRE-O-87/63)

ALDER, B. J., Triplet correlations in hard spheres, 18: 16568

ALESSANDRINI, A., Critical heat flux and pressure drop measurements in round vertical tubes, 18: 16172 (EURAEC-951)

ALEXANDER, W. D., Parathyroid function after I-131 therapy, 18: 15926

ALFORD, W. P., Reactions $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3,He^4)O^{15}$, 18: 16907 (ANL-6848(p.8-15))

ALGAR, L. E., Deuterium-filled thyratron, 18: 16167

ALIEV, Yu. M., Rate of equalization of plasma temperatures, 18: 17152

ALLAN, D. L., Cross sections of inelastic neutron collosions with Fe, Ni and Nb nuclei, 18: 16958 (NP-tr-1114)

ALLEN, A. O., Radiolytic oxidation of ferrous ion, 18: 16095

ALLEN, J. E., Collection of positive ions by a probe, 18: 17186

ALLEN, J. E., Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)

ALLENDEN, Dennis, Improvements relating to radioactivity alarm systems, 18: 16273

ALTMAN, K. I., Effect of thyroparathyroidectomy on radiation-induced creatinuria in rats, 18: 15876

ALVAREZ RIVAS, J. L., Flux distribution of thermal neutrons inside stack of foils, 18: 16901

AMADESI, P., Calibration of an absolute spectrometric system, 18: 16358

AMAEEV, A. D., Mechanical properties of construction materials under neutron radiation, 18: 16525 (NP-13657)

AMATO, Charles G., Dose distribution in animals subjected to whole-body x irradiation, 18: 15753

AMBROSE, T. P., Decrease of electron temperature by electric fields, 18: 16882

AMELINCKX, S., Observation of ferroelectric domains in Ba titanate by electron microscope, 18: 16556

AMENITSKII, N. A., Spectrometer for investigating spin-lattice relaxation spectra, 18: 16342

AMIS, E. S., Vapor-liquid equilibrium of the UF_6—decafluorobis-(trifluoromethyl) cyclohexane, C_9F_{18}, system, 18: 15995 (K-271)

ANAND, J. S., Synthesis of methane from water for tritium measurement, 18: 16075

ANDERSEN, E. J., Effects of nuclear detonations in the atmosphere, 18: 16859

ANDERSEN, H. C., Preservation of canonical distribution in Markovian relaxation processes, 18: 16417

ANDERSEN, T., Szilard-Chalmers process in dichromates, 18: 16115

ANDERSON, A. R., Gamma radiolysis of H_2O vapor, 18: 16105

ANDERSON, Barbara B., Measurement of G-I absorption of Co^{58}-labeled vitamin B_{12}, 18: 15799

ANDERSON, E., Etch-pit observations concerning twins in Fe and Fe alloys, 18: 16471 (EURAEC-978)

ANDERSON, E. C., Cesium-137 body burdens of control subjects, 18: 16224 (LAMS-3034(p.180-3))

ANDERSON, E. C., Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))

ANDERSON, E. C., Evaluation of K-40 continuum contribution to Cs-137 photopeak in spectrometer, 18: 16302 (LAMS-3034(p.162-7))

ANDERSON, E. C., Humco II status, 18: 16300 (LAMS-3034(p.143-51))

ANDERSON, J., Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)

ANDERSON, J. R. A., Use of copolymerized celluloses in chromatography, 18: 16145

ANGHILERI, Leopoldo Jose, Stability of Cr^{51}-labeled serum albumin, 18: 15793

ANISSIMOV, A. I., Charged-particle diffusion in magnetic field, 18: 17227

ANNO, J. N., Conversion of α particle energy into electricity, 18: 16745

ANTIPOV, V. F., Apparatus for measuring angular distribution of annihilation radiation of positrons, 18: 16304 (NP-13693)

AONO, Osamu, Unified theory of relaxations in plasmas, 18: 17106 (IPPJ-17)

AOYAMA, T., Radiosensitivity and SH compounds in mammalian cells, 18: 15897

ARAKAWA, E. T., Angular and spectral distributions of light emitted from electron-bombarded Ag foils, 18: 16649 (ORNL-3485)

ARAKAWA, E. T., Detection of plasma radiation from electron-bombarded Al and Mg, 18: 16670

ARCHAMBAULT, J., Underground storage for radioactive wastes, 18: 17340

ARCHULETA, R. F., Acute radiosensitivity as function of age in mice, 18: 15807 (LAMS-3034(p.112-15))

ARCHULETA, R. F., Inability of mouse to recognize γ radiations. I., 18: 15811 (LAMS-3034(p.133-40))

ARCHULETA, R. F., Radiation-induced irreparable biological damage in mice, 18: 15810 (LAMS-3034(p.129-32))

AREND, Peter C. Vander, Separating isotopes of H, 18: 16407

ARENDT, P. R., Non-relativistic Doppler shift in the ionosphere, 18: 16876

ARF, Cahit, Algebraic structure of cluster expansions in statistical mechanics, 18: 16412 (CNAEM-14)

ARGIERO, L., Sorption of Sr-90 and Cs-137 in wheat, 18: 15761

ARMSTRONG, B. H., Binding energy of H^-, 18: 16674

ARNEY, George D., Jr., Gasdynamic diagnosis of flows from plasma states, 18: 17136

ARNIKAR, H. J., Surface self-diffusion of adsorbed atoms, 18: 16479 (TID-7689(p.86-9))

ARONOW, Saul, Gallium-68 as a scanning agent, 18: 15931

ARONOW, Saul, Labeling of human globulin with I-124, 18: 15933

ARRHENIUS, Gustaf, Separation of U, Th, and rare earths by anion exchange, 18: 16131

ARROYO, A., Isotopic exchange of Fe between $FeCl_3$ and Fe cupferrate, 18: 16402

ASATIANI, T. L., Polarization of cosmic muons and determination of ratio $K^+/K^+ + \pi^+$, 18: 16762 (NP-13694)

ASTIER, A., Resonances of strongly interacting particles, 18: 16770

ASUNDI, R. K., Ionization cross section for the rare gases, 18: 16696

ATEN, A. H. W., Jr., Measurement of fast neutron flux, 18: 16356

ATKIN, R. H., Theoretical electromagnetism, 18: 16578

ATKINSON, H. R., Estimating radiation to the blood-forming organs, 18: 15847

ATTIX, F. H., Thermoluminescence methods in personnel dosimetry, 18: 16361

ATWOOD, K. C., Radiomimetic action of polyimine chemisterilants in *Neurospora*, 18: 15868

AUERBACH, S. I., Landscape investigations using Cs-137, 18: 15762

AURICCHIO, F., Effect of x rays on movements of Na in human erythrocytes, 18: 15873

AUSTIN, Pauline M., Prog. rpt. on fallout prediction, 3–5/63, 18: 16202 (AD-416645)

AVRIL, M., Problems posed by treatment of nuclear physics data, 18: 16322

AVVAKUMOV, E. G., Separation of lanthanides in NH_4NO_3 by zone crystallization. III., 18: 16137

AWA, Akio, Chromosomal studies on irradiated human leukocytes, 18: 15840

AXELROD, E. H., Proton mobility and electron exchange in aqueous media, 18: 16019

AZIZOV, S. A., Effects of γ radiation on adsorptive properties of synthetic zeolites, 18: 16118

B

BAARLI, J., Nuclear stars in personnel neutron track films, 18: 16262

BABCOCK, R. V., Stimulated emission of γ radiation, 18: 16952 (TID-20313)

BABUSHKIN, F. A., Isotopic shift in x-ray spectra, 18: 17064

BACH, G. R., Continuum radiation from arc-heated plasmas, 18: 17135

BACHELIER, D., Study of Ca-40, B-11, and B-10 by (p,d) reaction, 18: 17043

BACHNER, Paul, Pathologic anatomy of deuterium intoxication, 18: 15800

BACKUS, M. M., Ocean-bottom seismic measurements off California coast, 18: 16198

BADAREU, Eugen, Resonant transfer of electric charge in monoatomic gas, 18: 16708

BADEN, Howard P., Determination of C-14 and H-3 by flask combustion, 18: 15973

BAETSLE, L., Movement of radioelements in soil, 18: 17341

BAGNALL, K. W., Transuranium elements, 18: 16051

BAILEY, C. A., Ground state in Ce Mg nitrate, 18: 16574

BAILEY, D. K., Occurrence of polar cap absorption, 18: 16824

BAILEY, P. B., Correction to invariant imbedding equations of transport theory, 18: 16899

BAILEY, P. B., Invariant imbedding equations of transport theory, 18: 16898

BAIN, Walter F., Solar-induced effects on vhf ionospheric radio propagation, 18: 16839

BAKER, Charles E., Thermal conductivities of gaseous H_2O, D_2O, and H_2O–D_2O, 18: 16020

BAKER, Charles P., Effects of heavy high-energy charged particles. II., 18: 15827

BAKER, Charles P., Effects of heavy high-energy charged particles. IV., 18: 15829

BAKER, John C., Boundary shape between plasma and magnetic field, 18: 17165

BALDEWEG, Frank, Energy and energy distribution of cyclotron rays, 18: 16611 (ZFK-PHA-5)

BALIAN, R., Spurious states in the quasi-particle approximation, 18: 17082

BALL, Con O. T., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)

BALL, F. F., Radiotracer analysis of catalyst flow distribution, 18: 16390 (TID-7688(p.84-90))

BALL, G., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)

BALL, R. M., Reactivity behavior at Indian Point, 18: 17312

BALLARD, L. F., Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))

BALLINI, R., Coincidences due to reactions of Li-6 on Li-6 and Be-9, 18: 17005

BALLOT, J. L., Simple model of stripping reaction on Be-9 and N-14, 18: 17053

BALLOU, Nathan E., Method of solvent extraction, 18: 16157

BANASIK, Zbigniew, Apparatus for continuous abrasion control using radioisotopes, 18: 16394

BANDIRALI, G. R., Radiosensitivity of Walker tumors in hibernating rats,

18: 15878
BANKS, Charles, Chemical analysis of alkali metal W bronzes, 18: 15952 (IS-800)
BAQUE, P., Zirconium alloys resistant to CO_2, 18: 16439 (CEA-2393)
BARABOI, V. A., Anti-radiation properties of gallates, 18: 15904
BARABOY, V. A., Antiradiation properties of gallates, 18: 15896 (JPRS-23834)
BARANY, Janos, Hit theory, 18: 15865
BARAT, Michel, Discrete energy losses of a fast proton beam, 18: 16713
BARBER, S. A., Rubidium-86 diffusion in soil and kaolinite systems, 18: 16199
BARBER, S. A., Uptake of Rb-86 by corn, 18: 15801
BARBIER, G., Radioelement infiltration forecast, 18: 16217
BARBREAU, A., Radioisotope retention by soft earth material, 18: 16215
BARI, W. A., Effects of x radiation on spleen in rat, 18: 15863
BARKER, James J., Measurement of diffusivity in high viscosity liquid, 18: 15998 (TID-7688(p.52-63))
BARKOV, L. M., Equipment for processing bubble chamber photographs, 18: 16336
BARNES, P. D., Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))
BARNES, R. C. M., Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)
BARNES, W. S., Mobilities of mass-indentified ions in N, 18: 16057
BARNETT, C. F., Formation of neutral atomic H beams, 18: 16703
BARTLETT, B. O., Ratios of Sr-90 to Ca in milk and in bones of infants, 18: 15796
BARTOLI, C., Measurement of large impulse currents in Candidi experiment, 18: 17120 (RT-FI(63)-49)
BARZ, H.-U., f-Calculation with transport theory, 18: 16955 (ZFK-TPH-1)
BARZ, Hans Ulrich, Theoretical study on zero reactor, 18: 17281 (ZFK-TPH-5)
BASMANN, N. J., Electronic measurement of cellular volumes. IV., 18: 15739 (LAMS-3034(p.235-52))
BASMANN, N. J., Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))
BASMANN, N. J., Electronic measurement of cellular volumes. VI., 18: 15741 (LAMS-3034(p.261-9))
BASTIN-SCOFFIER, G., Alpha spectrography of Ra-226 and levels of even-A Rn isotopes, 18: 16984
BATE, L. C., Application of activation analysis to forensic science. II., 18: 15977
BATES, D. R., Collisional-radiative recombination, 18: 17184
BATES, D. R., Ion-molecule rearrangement collisions, 18: 16676
BATES, D. R., Low-energy collisions between H atoms and protons, 18: 16684
BATSANOVA, L. R., Crystal-chemical studies of rare earth fluorides, 18: 16013
BATTIST, L., Radiochemistry during startup and operation of *Savannah*, 18: 17320 (NSEC-72)
BAUCHE, J., Hyperfine structure of PuI, 18: 17083
BAUDINET-ROBINET, Y., Angular distribution in reaction $Li^6(n,t)He^4$, 18: 16965
BAUDON, Jacques, Discrete energy losses of a fast proton beam, 18: 16713
BAUMANN, G., Mesic disintegrations of hyperfragments produced in emulsions, 18: 16979
BAUMANN, G., Nuclear reactions produced by absorption of π^- mesons by light nuclei, 18: 16978
BAXTER, R. J., Equilibrium properties of a two-dimensional system of particles, 18: 16809
BAZAN, Fernando, Prog. rpt. on high-altitude balloon sampling, 2/64, 18: 16203 (NYO-10496)
BEARD, David B., Boundary shape between plasma and magnetic field, 18: 17165
BEATY, Earl C., Reaction rates for the formation of He_2^+ and Ne_2^+, 18: 16722
BECK, R. N., Animal scanning system, 18: 15763 (ACRH-20(p.136-43))
BECKER, K., Different methods applied in personnel dosimetry, 18: 16365
BECKER, W., Temperature variation in F region during last sunspot cycle, 18: 16851
BECKMANN, B., Radio propagation disturbances, 18: 16843
BECKNER, Everet H., Flow of H plasma through transverse magnetic field, 18: 17174
BEDERSON, B., Prog. rpt. on low-density plasmas, annual, 18: 17121 (TID-20362)
BEEBE, Gilbert W., Studies of mortality of A-bomb survivors. II., 18: 15875
BEELER, J. R., Jr., Effects of channeling on damage production in Fe, 18: 16537
BEER, C. T., Metabolism of Vinca alkaloids, 18: 15790
BEKEFI, G., Relaxation rate of electrons to equilibrium, 18: 17233
BEKETOV, A. R., Kinetics of alpha UO_3 dissociation, 18: 16011
BELCHER, E. H., Measurement of G-I absorption of Co^{58}-labeled vitamin B_{12}, 18: 15799
BELL, J., Metabolism of Vinca alkaloids, 18: 15790
BELON, A. E., Geomagnetic agitation and overhead aurora, 18: 16860
BELOT, Y., Ground disposal injection of radioactive sludge, 18: 17346
BELOT, Yves, Kinetics of Sr-90 retention, 18: 17343
BELTER, W. G., Ground disposal, 18: 17337
BENARD, Jacques, Chemical activity of H desorbed from Pd, 18: 17368 (Al-Trans-37)
BENENSOHN, Howard, Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689(p.17-20))
BENENSON, W., Electromagnetic transition probabilities in O-16, 18: 16998
BENNETT, S., Gas-stabilized constricted arc, 18: 17134
BEN-REUVEN, A., Pressure-induced shifts of DCl lines due to HCl, 18: 16025
BENSON, G. M., Thorium breeder reactor histories, 18: 17302 (UCRL-7544)
BENSON, Royal H., Process gas flow rate measurements with Xe-133, 18: 16387 (TID-7688(p.76-8))
BERANEK, J., Program of ground disposal R and D, 18: 17339
BERDJIS, Charles C., Modification of anthrax by radiation, 18: 15858
BERENBLUM, I., Action of isologous bone marrow on radiation leukemogenesis, 18: 15899
BEREZHNOI, A. S., System $CaO-MgO-Al_2O_3-ZrO_2$, 18: 16490
BERGE, Philippe, Battle against corrosion, 18: 16445
BERGEDER, Hans-Dieter, Radiation necrosis of the cerebellum, 18: 15830
BERGER, Martin J., Electrons transmitted through Al_2O_3 foils, 18: 17244 (NASA-SP-3008)
BERNAS, H., Mössbauer effect in $FeCl_3 \cdot 6H_2O$, 18: 16036
BERNAS M., Study of Ca-40, B-11, and B-10 by (p,d) reaction, 18: 17043
BERNAS NEE PREVOT, Annette, Application of polymerization to radiation chemistry, 18: 16077 (NP-13734)
BERNHEIM, M., Inelastic scattering of electrons by Li-6 and Li-7, 18: 17026
BERNSTEIN, S., Vapor-liquid equilibrium of the UF_6—decafluorobis-(trifluoromethyl) cyclohexane, C_8F_{18}, system, 18: 15995 (K-271)
BERRETT, Paul O., Waves in circular plasma column, 18: 17130
BERRY, B. Stephen, Molecular ionization by electron impact, 18: 16692
BERSHADER, D., Shock tube studies of radiative transport in an Ar plasma, 18: 17173
BERTHELOT, Ch. A., Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
BERTHELOT, F. C., Total cross sections of Na, Th, and U for neutrons, 18: 16973
BERTIE, J. E., Infrared spectra of ices Ih and Ic, 18: 16021
BERTIE, J. E., Infrared spectra of Ices II, III, and V, 18: 16022
BERTIN, Eugene P., Determination of Nb and Sn on Nb_3Sn-coated metal ribbon, 18: 15972
BERTOLETTI, S., Heat transfer to steam–H_2O mixtures, 18: 16171 (EURAEC-929)
BERZINA, I. G., Effect of radiation on contact melting of metals, 18: 16538
BESCO, D. G., Effects of channeling on damage production in Fe, 18: 16537
BESSON, J., Dosage of H_2O_2 using uv spectrophotometry, 18: 15948 (CEA-2391)
BEST, G. C., Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)
BETHERY, M., Pulsation by modulation of beam of 150-kev deuterons, 18: 16614

BETHOUX, O., Dispersed nuclear fuels with non-metallic fissile phase, 18: 17289 (CEA-Bib-41)

BETOURNE, C., Excited states of O-16 by inelastic scattering of electrons, 18: 17027

BEURTEY, R., Polarized deuterons of Saclay cyclotron, 18: 16617

BEYNON, W. J. G., Height distortion of peak of E region, 18: 16864

BEYSTER, J. R., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)

BEZAGUET, A., Pion-nucleon cross section, 18: 16776

BIANCHI, G., Interaction of resonance neutrons with nuclei. I., 18: 17033

BIANCHI, G., Interaction of resonance neutrons with nuclei. II., 18: 17034

BIANCHI, G., Interaction of resonance neutrons with nuclei. III., 18: 17035

BIANCHI, G., Interaction of resonance neutrons with nuclei. IV., 18: 17036

BIANCHI, L., Source of Li ions, 18: 16615

BIBL, K., Solar flare effects in D and E region, 18: 16832

BILHORN, D. E., Remarks concerning reciprocity in quantum mechanics, 18: 16802

BILWES, R., Decomposition of levels in Be-8, 18: 17022

BILWES, R., Study of low levels of Li-6 by $Li^6(He^3,\alpha)Li^6$, 18: 17031

BINON, F., Angular correlations (γ-γ) in disintegration of Sb-124, 18: 17015

BIRARELLI, B., Influence of pan irradiation on plasma clearing, 18: 15879

BIRD, N. F., Calculation of density of electron states, 18: 16573

BIRKENSHAW, Doric, Self-engaging couplings, 18: 16169

BIRKHOFF, R. D., Angular and spectral distributions of light emitted from electron-bombarded Ag foils, 18: 16649 (ORNL-3485)

BIRKHOFF, R. D., Detection of plasma radiation from electron-bombarded Al and Mg, 18: 16670

BISHOP, G. R., Excited states of O-16 by inelastic scattering of electrons, 18: 17027

BISHOP, G. R., Inelastic scattering of electrons by Li-6 and Li-7, 18: 17026

BISHOP, G. R., Scattering of high-energy electrons in Al-27, 18: 16944 (LAL-1091)

BISHOP, G. R., Spectrum from inelastic scattering of electrons by C. II., 18: 17028

BISHOP, R., Scattering of high-energy electrons by P-31, 18: 17025

BISHOP, Vernon S., Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))

BISI, A., Positron annihilation in alkali halides, 18: 16665

BITTNER, J. W., Conference on storage rings, accelerators and experimentation at super-high energies, Brookhaven 6/10–7/19/63, 18: 16583 (BNL-7534)

BITTNER, J. W., Proton storage in AGS, 18: 16589 (BNL-7534(p.230-5))

BLACKMAN, V. H., Physics of pulsed MHD generators, 18: 16743 (MHD-646)

BLAIR, G. E., Energy- and rate-dependence studies, 18: 16305 (NP-13748)

BLAKE, M. I., Effect of D_2O on growth of peppermint. I., 18: 15861

BLANC, Daniel, Interaction of 14.1-Mev neutron with D, 18: 16964

BLANCHFIELD, J. R., Jr., Design and cost estimate for Na pump test facility, 18: 16166 (WCAP-2526)

BLANK, H., Observation of ferroelectric domains in Ba titanate by electron microscope, 18: 16556

BLATCHLEY, D. E., Inelastic scattering of α particles from C-12, Mg-24, Si-28, and Fe-56, 18: 16928 (ANL-6848(p.153-8))

BLAU, L. M., Reactions $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3,He^4)O^{16}$, 18: 16907 (ANL-6848(p.8-15))

BLAUNSHTEIN, I. M., Radiolysis of solid inorganic compounds, 18: 16119

BLECHSCHMIDT, C. W., Handling and transportation tests of PM-1, 18: 17299 (MND-M-1915)

BLEWETT, J. P., Method for injection into betatron phase space, 18: 16601 (BNL-7534(p.414-16))

BLOCH, M., Pion-nucleon cross section, 18: 16776

BLOCK, B., Multiparticle excitations in intermediate compound state, 18: 17079

BLUME, M., Theory of spin-orbit coupling in atoms. III., 18: 16664

BLUMLE, L. J., Distribution of ionization about the magnetic equator, 18: 16853

BLYUMKINA, Yu. A., Control apparatus and shielding of fast pulsed reactor, 18: 17325 (NP-13710)

BLYUMKINA, Yu. A., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)

BOBBI, Carlos, Radioresistance of *E. coli*, 18: 15898

BOBIN, K. J., Operation of BR-2 reactor, 3/31–4/21/63, 18: 17303 (NP-tr-1121)

BOBIN, K. J., Operation of BR-2 reactor, 4/21–5/12/63, 18: 17304 (NP-tr-1122)

BOBROVA, A. N., Conductivity of $TlAsSe_2$, $TlAsSe_4$, $As_2Se_2Te_2$, and As_2Se_2Te as function of γ dose, 18: 16541

BOCHIN, V. P., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092

BOCHIN, V. P., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093

BOCHKAREV, V. N., Scintillation γ spectrometer with fast neutron discrimination, 18: 16329

BOCKELMAN, C. K., Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))

BOERBOOM, A. J., Heat of sublimation and vapor pressure of Sr, 18: 16517

BOGATOV, L. V., Peculiarities in course and outcome of radiation sickness in dogs injected intravenously with nitrate of Pu-239, 18: 15817 (FTD-TT-63-559(p.150-72))

BOGEN, P., Influence of impurities on high-density D plasma, 18: 17179

BOHN, T., Applied magnetohydrodynamics. I., 18: 17107 (JUL-145-TP)

BOHUN, A., Exoelectron emission of KCl phosphors, 18: 16083

BOIATO, Louisa, Action of isologous bone marrow on radiation leukemogenesis, 18: 15899

BOKACHEVA, L. P., Space distribution of dose streams of capture γ radiation, 18: 16962

BOLLINI, C. G., Divergences of quantum field theories, 18: 16808

BOLOTIN, Yu. L., Interaction between particles and waves with plasma, 18: 17157

BOMPIANI, C., Dose distribution in grid therapy with 15-Mev electrons, 18: 15943

BONAZZOLA, G. C., Angular distribution of fast neutrons scattered by Fe, 18: 17048

BOND, V. P., Mitotic delay in erythroblasts of the dog, 18: 15874

BOND, Victor P., Dose distribution in animals subjected to whole-body x irradiation, 18: 15753

BOND, W. H., Radiation damage to thoracic tissues, 18: 15888

BONDAR, L., π^-P interactions at 4.0 Bev/c. I., 18: 16774

BONDARENKO, I. I., Group constants of fast and intermediate neutrons for designing reactors, 18: 17287 (NP-13666)

BONDARENKO, I. I., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)

BONGARTZ, K., π^-P interactions at 4.0 Bev/c. I., 18: 16774

BONHAM, R. A., Scattering factors for x rays and electrons, 18: 16656

BONNER, T. W., Investigation of C-12 + He-3 reactions between 1.8 and 5.4 Mev, 18: 17060

BOODNIKOV, V. N., Charged-particle diffusion in magnetic field, 18: 17227

BOONE, D. H., Tensile properties of pyrolytic W, 18: 16504

BOONE, I. U., Chromosomes in transplanted leukemia of mice, 18: 15744 (LAMS-3034(p.307-11))

BOONE, I. U., Chromosome observations in nonirradiated progeny from irradiated RF males, 18: 15812 (LAMS-3034(p.303-6))

BOONE, I. U., Preparation of bacterial deoxyribonucleic acids, 18: 15776 (LAMS-3034(p.288-95))

BOONE, I. U., Purification of T-4 bacteriophage on DEAE cellulose columns for DNA isolation, 18: 15777 (LAMS-3034(p.296-302))

BOPP, C. D., Measurement of thermal conductivity with Hg contacts, 18: 16533

BORCHARDT, G., Neutron measurements on paraffin pile, 18: 16892 (JUL-140-RX)

BORISENKO, V. A., Hardness of W, 18: 16519

BORISENKO, V. A., Hardness of Mo, 18: 16518

BORLAND, R. E., Calculation of density of electron states, 18: 16573

BORN, James L., Suppression of pituitary function in diabetic retinopathy, 18: 15927

BOROS, I., Changes in immunity due to ionizing rays, 18: 15881

BOROVIK, E. S., Filling of magnetic trap GVL-2 with plasma, 18: 17108 (NP-13609)

BOSCHI, A., Measurement of large impulse currents in Cariddi experiment, 18: 17120 (RT/FI(63)-49)

BOSCHI, A., Space charge aspects of r-f plasmoids, 18: 17238

BOSSARD, J., Zirconium alloys resistant to CO_2, 18: 16439 (CEA-2393)
BOSSOLASCO, M., Solar effects on radio wave propagation, 18: 16838
BOUCHEZ, R., Excitation of C-12 by scattering of neutrons, 18: 16967
BOUCIQUE, R., Mobility of positive ions in Geiger discharges, 18: 16351
BOULASSIER, J. C., Abnormal resistivity of plasma, 18: 17224
BOUNIN, P., Scattering of high-energy electrons in Al-27, 18: 16944 (LAL-1091)
BOUNIN, Paul, Spectrum from inelastic scattering of electrons by C. II., 18: 17028
BOURE, J., Hydrodynamic instability in boiling channel, 18: 16180 (AEC-tr-6364)
BOUROTTE, B., Decomposition of levels in Be-8, 18: 17022
BOURRIER, M., Evolution in terms of percolation rate, 18: 16010
BOVARD, P., Retention of Ru-106 + Rh-106 in soils, 18: 17345
BOVARD, P., Study of radioelement migration in soils, 18: 16216
BOWE, Joseph G., Mobility of electrons in the noble gases, 18: 16668
BOWEN, P. J., Plasma probe experiments on Ariel satellite, 18: 17191
BOWHILL, S. A., Ion temperatures from electron distribution above F2 layer maximum, 18: 16852
BOYD, R. L. F., Plasma probe experiments on Ariel satellite, 18: 17191
BOYER, J., Retention of Ru-106 + Rh-106 in soils, 18: 17345
BOZAZYANTS, N. O., Group constants of fast and intermediate neutrons for designing reactors, 18: 17287 (NP-13666)
BOZOKI, D., Scattering constant K_0 in NIKFI-R emulsions, 18: 16339
BRACKMANN, R. T., Electron collisions with atomic and molecular O, 18: 16694
BRADFUTE, J. O., Prog. rpt. on burnout in boiling water, 7–9/63, 18: 16184 (EURAEC-883)
BRADSHAW, A. L., Physical aspects of electron therapy, 18: 15922
BRADY, G. A., Effect of γ radiation on anthracite, 18: 16523 (BM-RI-6391)
BRANDT, B., Electrons and active N, 18: 17098
BRANDUS, Lucien, Resonant charge transfer in ionized dense gases, 18: 16725
BRAUN, H., Mesic disintegrations of hyperfragments produced in emulsions, 18: 16979
BRAUN, H., Nuclear reactions produced by absorption of π^- mesons by light nuclei, 18: 16978
BRAYER, R. C., Prog. rpt. on burnable poison additions to UO_2, 2/63, 18: 16468 (CEND-203)
BREARE, J. M., Measuring electron drift velocities, 18: 16723
BREIT, Gregory, Prog. rpt. on nucleon-nucleon interaction, annual, 2/64, 18: 16953 (TID-20352)
BREMSAK, France, Equipment for continuously recording γ radiation, 18: 16312
BRESCIA, G., Relaxation-time determination in quadrupolar resonance, 18: 16041
BRESCIANI, F., Effect of x rays on movements of Na in human erythrocytes, 18: 15873
BRESESTI, M., Preparation of F-18 in nuclear reactor, 18: 16111
BRESSANI, T., Angular distribution of fast neutrons scattered by Fe, 18: 17048
BREWER, L. E., Population of excited states in thermal plasma, 18: 17215
BREWER, L. E., Thermal equilibrium in electrical discharges, 18: 17216
BREWER, Ruth, Radiation effect on the kidney, 18: 15880
BRICKA, M., External radiation dosimetry practices in the CEA, 18: 16267
BRINDLEY, J. H., Isothermal turbulent flow through fuel geometries, 18: 17253
BRINK, D. M., Fluctuations in radio astronomy, 18: 16637
BRINK, G. O., Absolute ionization cross sections of the alkali metals, 18: 16666
BRINK, G. S., Local seismic monitoring in Shoal, 18: 16190 (NP-13757)
BRINKMAN, G. A., Measurement of fast neutron flux, 18: 16356
BRISSAUD, I., Study of Ca-40, B-11, and B-10 by (p,d) reaction, 18: 17043
BROCK, Kirby, Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
BROCKWAY, M. Clifford, Carbons and graphites—production and use, 18: 16429
BROIDO, J. H., Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)
BROKAW, Richard S., Thermal conductivities of gaseous H_2O, D_2O, and H_2O–D_2O, 18: 16020
BROOKS, C. S., Methylene blue dye adsorption on siliceous minerals, 18: 16193 (TID-7689(p.85-6))
BROOKS, M. R., Breeding characteristics of offspring from mice with fifteen generations of x irradiation, 18: 15809 (LAMS-3034(p.124-8))
BROOKS, Richard O., Transient response of linear undamped and lightly damped lumped spring-mass systems, 18: 17360 (TID-18775)
BROPHY, J. H., Zirconium–W–Ta system, 18: 16503
BROVETTO, P., Angular distribution of fast neutrons scattered by Fe, 18: 17048
BROWN, A. R. G., Titanium–Nb system, 18: 16508
BROWN, B. P., Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
BROWN, G. M., Height distortion of peak of E region, 18: 16864
BROWN, H. H., Jr., Prog. rpt. on low-density plasmas, annual, 18: 17121 (TID-20362)
BROWN, J. L., Health physics following nuclear excursion, 18: 16242
BROWN, James Robert, Radioactivity contamination monitor, 18: 16372
BROWN, John L., Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
BROWN, Paul L., Neutron meter access tubes, 18: 16201
BROWN, Sanborn C., Electron energy decay in He afterglow, 18: 17232
BROWN, V. M., Concentrations of Ca, Sr, and Sr-90 in wild brown trout, 18: 16243
BROWN, W. Lynn, Comparisons of normal and irradiated monkeys, 18: 15853
BROWN, W. Lynn, Extinction by normal and whole-body irradiated monkeys, 18: 15852
BROWN, W. Lynn, Response latencies of normal and focal-head irradiated monkeys, 18: 15851
BROWNELL, Gordon L., Gallium-68 as a scanning agent, 18: 15931
BROWNELL, L. E., Radiotracers for leak detection in Saturn vehicle, 18: 16392 (TID-7688(p.95-7))
BRUCE, R. S., Ratios of Sr-90 to Ca in milk and in bones of infants, 18: 15796
BRUMFIELD, R. C., Physics of pulsed MHD generators, 18: 16743 (MHD-646)
BRUN, J. C., Device for multidimensional analysis in nuclear physics, 18: 16321
BRUNNER, E. H., Gammacardiography, 18: 15925
BRYSON, D. A., Characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
BUCKEY, C. R., Research on ion beam formation from plasma sources, 18: 17240
BUCKHAM, J. A., Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
BUCKMAN, J. D., Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)
BUGENIS, C., Tracer study of vacuum distillation and thin film deposition, 18: 16386 (TID-7688(p.40-3))
BUGENIS, C., Use of isotopes in ring and linear vacuum distillation source studies, 18: 16000 (TID-7689(p.96-103))
BULA, K., Charge/discharge facilities of "Diorit" reactor, 18: 17329
BULLOUGH, K., Radio aurora in high latitudes, 18: 16861
BURCH, George E., Transfer of Se-75 across pericardium of dogs, 18: 15804
BURDET, Guy, Production of two photons in Compton effect, 18: 16771
BURDG, C. E., Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)
BURDUCEA, O., Hemagglutination-inhibiting antibodies in rats subjected to radiation, 18: 15820
BURET, M., Scattering of 14-Mev neutrons by C-12: excited states, 18: 16968
BURG, C., Radiochemical determination of Sr-90 in rain water, 18: 15958 (SCPRI(S)-81)
BURHOP, E. H. S., Experimentation with colliding proton beams, 18: 16592 (BNL-7534(p.277-307))
BURHOP, E. H. S., Storage rings, 18: 16590 (BNL-7534(p.236-7))
BURKE, P. G., Excitation of He^+ by electrons, 18: 16681
BURMEISTER, H., π^-P interactions at 4.0 Bev/c. I., 18: 16774
BURNS, W. G., Radiolysis of cyclohexane, 18: 16102
BURRILL, E. A., Activation analysis with Van de Graaff neutron sources, 18: 15956 (NP-13762)

BUSOL, F. I., Filling of magnetic trap GVL-2 with plasma, 18: 17108 (NP-13609)
BUSOL, F. I., Optimum parameters of GVL-2 magnetic system, 18: 17116 (NP-13711)
BUSTRAAN, M., Critical facility KRITO, 18: 17276 (EUR-498.e)
BUSTRAAN, M., Subcritical facility PUK, 18: 17277 (EUR-499.e)
BUTLER, S. T., Production of highly excited neutral atoms for injection into plasma devices, 18: 17118 (NP-13744)
BYRON, Stanley, Gasdynamic instrumentation of high-enthalpy flows, 18: 17145

C

CABE, J., Inelastic scattering of 800-kev neutrons by I-127, 18: 17039
CAFFREY, R. W., Effect of irradiation on long-lived lymphocyte of the rat, 18: 15872
CAHEN, G., Summary of nuclear energy, 18: 17375
CALDWELL, D. O., Elastic scattering ($\pi^{\pm}$-p and p-p), 18: 16789
CALIA, P., Bubble motion in fluidized solid/gas systems, 18: 16181 (AERE-Trans-997)
CALOP, R., Vitamin B_{12} therapy of postradiotherapeutic hematological complications, 18: 15902
CALVO, Wenceslao G., Effects of heavy high-energy charged particles. I., 18: 15826
CALVO, Wenceslao G., Effects of heavy high-energy charged particles. II., 18: 15827
CALVO, Wenceslao G., Effects of heavy high-energy charged particles. IV., 18: 15829
CAMBEL, Ali Bulent, One-dimensional magnetogasdynamic flow, 18: 17172
CAMBOU, Francis, Interaction of 14.1-Mev neutron with D, 18: 16964
CAMERON, W. H., Index of Ionospheric Storminess, 18: 16845
CAMPBELL, E., Preparation of bacterial deoxyribonucleic acids, 18: 15776 (LAMS-3034(p.288-95))
CAMPBELL, E., Purification of T-4 bacteriophage on DEAE cellulose columns for DNA isolation, 18: 15777 (LAMS-3034(p.296-302))
CAMPBELL, R. W., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
CANDES, P., External radiation dosimetry practices in the CEA, 18: 16267
CANDLIN, John P., Kinetics of reduction of Co(III) complexes, 18: 16018
CANFIELD, Eugene, SOPHIST-5—code which calculates energy transfer for neutron scattering, 18: 16897 (UCRL-7624)
CAPRARU, R., Hemagglutination-inhibiting antibodies in rats subjected to radiation, 18: 15820
CAPRINO, L., Iodide concentration and the secretory activity of the thyroid, 18: 15788
CAPRINO, L., Thyroid fixation of radioiodine, 18: 15787
CARDEN, William H., Gasdynamic diagnosis of flows from plasma states, 18: 17136
CARDINAUD, Robert, Isotope effect on H bonds, 18: 16066 (NP-13736)
CARLSON, B. C., Normal elliptic integrals of first and second kinds, 18: 17354 (IS-639)
CARLSON, R. W., Dynamic properties of Langmuir probes. I., 18: 17182
CARLSON, R. W., Dynamic properties of Langmuir probes. II., 18: 17183
CARLSON, W. G., Ionic conductivity of CaO–Y_2O_3–ZrO_2, 18: 16014
CARLTON, J. E., Demonstration of delayed excretion of Fe-59, 18: 15934
CARMAN, P. C., Self-diffusion in mixtures. VI., 18: 16054
CARON, C., Ground disposal injection of radioactive sludge, 18: 17346
CARPENTER, C. M., Immunogenicity of irradiated *Mycobacterium tuberculosis*, 18: 15824
CARR, Thomas D., Field-aligned ducts in escape of decameter radiation from Jupiter, 18: 16646
CARROLL, D. F., Plutonium nitride and refractory nitrides, 18: 16473 (HW-SA-3370)
CARSWELL, Allen I., Supersonic plasma streams, 18: 17176
CARTER, J. R., Preparation and properties of Ca and Sr scandates, 18: 16015
CARTER, L. L., Determination of the relative worth of Pu atoms, 18: 16736 (HW-79413)
CASABIANCA, M., Isotopic exchange of Fe between FeCl, and Fe cupferrate, 18: 16402
CASARETT, George W., Radiation effects on sperm production of dogs, 18: 15892
CASSAGNOU, Y., Cross sections from $Al^{27}(d,\alpha)Mg^{25}$ reactions, 18: 17072
CASSAGNOU, Y., Partial excitation functions for $V^{51}(p,n)Cr^{51}$ reactions, 18: 16996
CASTORINA, T. C., Adsorption isotherm of surfactant on organic substrate, 18: 16384 (TID-7688(p.31-7))
CAVALLINI, A., Calibration of an absolute spectrometric system, 18: 16358
CAVENOR, M. C., Analysis of afterglow plasma in Ar, 18: 17234
CAVERZASIO, C., Parameters P and D in p-p scattering at 138 Mev, 18: 16772
CAVIN, O. B., Monoclinic-cubic transformation in ThC_2, 18: 16477 (ORNL-3588)
CAVINA PRATESI, A., Radiosensitivity of Walker tumors in hibernating rats, 18: 15878
CENCIOTTI, L., Influence of pan irradiation on plasma clearing, 18: 15879
CENDALES, M., Isotopic exchange of Fe between FeCl, and Fe cupferrate, 18: 16402
CEPLEANU, M., Hemagglutination-inhibiting antibodies in rats subjected to radiation, 18: 15820
CERNY, J., Strongly populated levels of $(d_{5/2})^{\frac{1}{2}}$ and $(f_{7/2})^{\frac{1}{2}}$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))
CERNY, Joseph, Reactions (p,t), (p,He^3), and (p,α) on O-16, 18: 16936 (ANL-6848(p.208-16))
CERNY, Joseph, "Spherical hot spots" from π capture in explosives, 18: 16026
CERRAI, E., Chromatography on alkali metals and alkaline earths, 18: 16141
CEULEMANS, H., Determination of spin resonances in $Sm^{149} + n$, 18: 17037
CEULENEER, R., Excitation of collective levels by He-3, 18: 17020
CHAIKOVSKII, V. G., Corona discharge detectors for slow neutrons, 18: 16328
CHALFANT, J. R., Reactivity coefficient of Al in PMA, 18: 16738 (KAPL-M-6121)
CHAMBERLAIN, A. C., Removal of I from gas streams, 18: 16033
CHAMBERLAIN, J., Autoradiography of H-3 on chromatograms, 18: 15984
CHAMINADE, R., Polarized deuterons of Saclay cyclotron, 18: 16617
CHANDLER, Willis T., Attack of refractory metals by alkali metals, 18: 16447
CHANG, Chien, Differential cross section for proton groups from $Al^{27}(d,p)Al^{28}$, 18: 17091
CHAPMAN, R. H., HRE-2 design report, 18: 17326 (ORNL-TM-348)
CHAPMAN, S., Lower limit of latitude of northern quiet auroral arcs, 18: 16821
CHARKES, N. David, Photoscanning with Sr-85, 18: 15932
CHARLESTON, D. B., Animal scanning system, 18: 15763 (ACRH-20 (p.136-43))
CHARLOT, Gaston, Separating Zr and Hf, 18: 16155
CHAYTOR, D., Attempt to detect and titrate Rous sarcoma virus-producing cells, 18: 15838
CHECHEV, V. P., β_5 component in Pb-210 decay, 18: 17094
CHEDIN, P., Determination of intensity of γ transitions by external conversion, 18: 16320
CHEDIN, P., Internal conversion coefficients of Eu-153 transitions, 18: 17016
CHEN, Kenneth, Prog. rpt. on two-phase flow, 3/9/64, 18: 16178 (TID-20336)
CHERDYNTSEV, V. V., Geochronology of the quaternary period, 18: 16219
CHEREVATENKO, V. L., Control apparatus and shielding of fast pulsed reactor, 18: 17325 (NP-13710)
CHERNETSKII, A. V., Gas-discharge pulse apparatus for testing plasma diagnostic equipment, 18: 17114 (NP-13705)
CHERNIACK, George B., High-temperature behavior of $MoSi_2$ and Mo_5Si_3, 18: 16499
CHERNICK, Cedric L., Xenon tetroxide: preparation and properties, 18: 16052
CHERNOCK, W. P., Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)
CHERNOCK, W. P., Prog. rpt. on burnable poison additions to UO_2, 2/63, 18: 16468 (CEND-203)
CHERUBENI, J. H., Fast activation analysis with Van de Graaff neutron

sources, 18: 15955 (NP-13761)
CHERY, R., Internal conversion electrons of $Pm^{151} \rightarrow Sm^{151}$, 18: 17017
CHEVALLIER, P., Double γ emission in monopolar transitions, 18: 16999
CHEVALLIER, P., Electromagnetic transition probabilities in O-16, 18: 16998
CHIAVASSA, E., Angular distribution of fast neutrons scattered by Fe, 18: 17048
CHICK, Helen J., Concentration region of homogeneity of carbides of transition metals, 18: 16483 (AEC-tr-6374)
CHIKOVANI, G. E., Track spark chamber, 18: 16327
CHING, Chang-jui, Probability of $\mu^- + Li^6 \rightarrow He^6 + \nu$, 18: 17087
CHIZARI, Eugenio, Changes in immunity due to ionizing rays, 18: 15881
CHOLLET, J., Scattering of high-energy electrons in Al-27, 18: 16944 (LAL-1091)
CHOONG, Shin-piaw, Influence of x rays on etching of quartz, 18: 16535
CIOBANU, G., Movement of positive ions in inhomogenous electric field, 18: 17221
CIOBOTARU, Dumitru, Resonant transfer of electric charge in monoatomic gas, 18: 16708
CIRCEO, Louis J., Jr., Engineering properties and applications of nuclear excavations, 18: 16162 (UCRL-7657)
CLAASSEN, H. A., Applied magnetohydrodynamics. I., 18: 17107 (JUL-145-TP)
CLAASSEN, Howard H., Xenon tetroxide: preparation and properties, 18: 16052
CLARK, D., Titanium–Nb system, 18: 16508
CLAYTON, Donald D., Chronology of the galaxy, 18: 16639
CLEBSCH, Alfred, Jr., Movement of radionuclides in the earth environment, 18: 16207
CLEMENT, M., Abnormal resistivity of plasma, 18: 17224
CLIFFORD, F. E., Note on metal-deficient red giant stars, 18: 16634
CLINE, D., Reactions $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3,He^4)O^{15}$, 18: 16907 (ANL-6848(p.8-15))
CLORFEINE, A. S., Frequency conversion in superconducting films, 18: 16879
CLOUTIER, Giles G., Supersonic plasma streams, 18: 17176
COCHE, A., Discrimination of particles in organic scintillators, 18: 16324
CODLING, K., Autoionization in He using synchrotron light source, 18: 16716
COEHOORN, J., Critical facility KRITO, 18: 17276 (EUR-498.e)
COFFIN, J. P., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000
COGGER, E. E. J., Electric, magnetic, and seismo-electric signals from nuclear explosions, 18: 16546 (AWRE-O-87/63)
COGLIATI, G., Catalytic reduction of U(VI) by formic acid, 18: 15997 (RT/CHI(63)-32)
COHEN, Marvin L., Superconductivity in many-valley semiconductors and in semimetals, 18: 16887
COLE, R. K., Ion beam neutral component determinations, 18: 16581
COLES, B. R., Low-temperature resistance anomaly in alloys, 18: 16511
COLLINS, A. Gene, Determining Be in Oil-field waters, 18: 15967
COLLINS, C. B., Helium metastable admixed gas reactions, 18: 16719
COLLINS, Elliott J., Kinetics of steroid effects on Ca-47 dynamics in dogs. I., 18: 15795
COLLINS, H., Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
COLMIN, J., Interaction of resonance neutrons with nuclei. I., 18: 17033
COLMIN, J., Interaction of resonance neutrons with nuclei. II., 18: 17034
COLMIN, J., Interaction of resonance neutrons with nuclei. III., 18: 17035
COLMIN, J., Interaction of resonance neutrons with nuclei. IV., 18: 17036
COLOMBO, Umberto P., Determination of trace metals in petroleum, 18: 15968
COLONNA, GARY, Transfer of Se-75 across pericardium of dogs, 18: 15804
COLUCCI, V., Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
COMES, F. J., Ion formation in Kr, Ar, and Ar–N mixtures, 18: 16720
CONARD, Robert A., Intraoral findings in humans after exposure to fallout. I., 18: 15843
CONCANNON, Joseph P., Radiation effect on the kidney, 18: 15880
CONJEAUD, M., Inelastic scattering of 14.1-Mev neutrons by S-32, 18: 16972
CONLON, T. P., Process start and control procedures, 18: 17357 (SC-DC-64-378)
CONNORS, J. F., Gas-stabilized constricted arc, 18: 17134
CONRAD, Edward E., Radiation-induced cable currents. I., 18: 16522 (AD-429954)
CONSOLI, Terenzio, Plasma acceleration by field gradients, 18: 17151
CONSTANTINIDES, C., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
COOK, C. J., Ion-molecule rearrangement collisions, 18: 16676
COOK, G. R., Photoionization and absorption spectra of several gases, 18: 16718
COOK, M. J., Estimates of $(MPC)_w$ for Sr-90, Sr-89, and Sr-85, 18: 15907
COOPER, Alan Alfred, Improvements in nuclear reactor plant, 18: 17269
COOPER, J., Conduction between electrodes in shock-heated Ar, 18: 17222
CORACHAN, Amparo, Slow absorption curves of I-131 from G-I tract, 18: 15791
CORCORAN, Cornelia, Labeling of human globulin with I-124, 18: 15933
CORGE, C., Interaction of resonance neutrons with nuclei. I., 18: 17033
CORGE, C., Interaction of resonance neutrons with nuclei. II., 18: 17034
CORGE, C., Interaction of resonance neutrons with nuclei. III., 18: 17035
CORGE, C., Interaction of resonance neutrons with nuclei. IV., 18: 17036
CORMIER, R. J., Classification of ionospheric storm types, 18: 16844
CORMIER, R. J., Index of Ionospheric Storminess, 18: 16845
CORNELL, Anthony, Chemical activity of H desorbed from Pd, 18: 17368 (AI-Trans-37)
CORNELL, Anthony, Dependence of sheet metal surface roughness on pretreatment, 18: 16457 (AI-Trans-41)
CORNELL, Anthony, Relaxation phenomena in cold-worked Cu, 18: 16484 (AI-Trans-34)
CORNELL, Anthony, Saturation phenomena of defect production by irradiation at low temperature, 18: 16531 (AI-Trans-38)
CORONITI, S. C., Arctic communications following solar disturbances, 18: 16841
CORSAN, J. M., Non-linear resistance in Bi, 18: 16660
CORUM, J. M., Instantaneous collapse and creep buckling of shells, 18: 16159 (ORNL-3555)
COSGAREA, Andrew, Jr., Diffusion phenomena in liquid Cd–Pb binary system, 18: 16480 (TID-20326)
COSTA, Giovanni, Theory of elementary particles, 18: 16758 (CERN-64-13(Vol.III)(p.1-79))
COSTE, J., Longitudinal dielectric constant of fully ionized plasma, 18: 17202
COSTE, M., Gamma rays from reaction of Li-6 on Li-6, 18: 17006
COTTIER, H., Mitotic delay in erythroblasts of the dog, 18: 15874
COTTINGHAM, J. G., Beam survival in Cosmotron, 18: 16588 (BNL-7534 (p.228-9))
COTTON, Irene M., Nitric oxide protection of bacteriophage against x-irradiation damage, 18: 15901
COTTS, R. M., Anomalous nuclear magnetic resonance linewidth in Li, 18: 17077
COURANT, E. D., Accelerators with nonlinear focusing, 18: 16599 (BNL-7534(p.399-405))
COUSSERAN, Pierre, Devices for anchoring and extracting plugs in fuel channel, 18: 17272
COWPER, G., Personnel dosimetry at Chalk River, 18: 16363
COX, W., Removing radioiodine from hot-off gas systems, 18: 16230 (TID-7688(p.68-74))
COZENS, J. R., Flame plasma, 18: 17213
CRAGGS, J. C., Afterglow studies of transient discharges, 18: 17231
CRAMER, E. M., X-my micrography of alpha Pu, 18: 16482 (UCRL-7651)
CRAMER, J. G., Jr., Angular momentum selection and angular correlations in direct reactions with strongly absorbed particles, 18: 16927 (ANL-6848(p.147-52))
CRAMER, J. G., Jr., Inelastic scattering of α particles from C-12, Mg-24, Si-28, and Fe-56, 18: 16928 (ANL-6848(p.153-8))
CRANE, F. A., Effect of D_2O on growth of peppermint. I., 18: 15861
CRANE, George E., Motion of fission fragments from HA explosions, 18: 16213
CRANSWICK, E. H., Improved equipment design for studies on thyroid uptake, 18: 15919
CRAVAROLO, L., High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)
CRAWFORD, F. W., Double sheath at discharge constriction, 18: 17237

CRAWLEY, G. M., Selection rules in $Ti^{48}(p,p')$ inelastic scattering, 18: 16930 (ANL-6848(p.168-71))
CREMIEU-ALCAN, E., Proceedings of sixth international conference on ionization phenomena in gases, Paris, 7/63. I., 18: 16689
CREUTZ, E., Behavior of β-γ directional correlation in disintegration of Ho-166, 18: 17011
CREUTZ, E., On the spin of ground state of Pr-144, 18: 17013
CRISTIANI, G., Joint AN/CNEN/NPPC irradiation program, 18: 17328
CRISTOFORI, F., Cross section for production of H atoms in the 2S state, 18: 16704
CROFT, William J., Geologic age determination by direct Pb isotope analysis, 18: 16218
CROMPTON, R. W., Ratio of drift speed to diffusion coefficient for quasi-thermal electrons, 18: 16724
CROSS, A. Marjorie, Time of action of thymus in irradiated adult mouse, 18: 15869
CROSSLEY, R. J. S., Glockler's equation for ionization potential. II., 18: 16680
CROWTHER, Peter, Evaluation of I-125 measurement techniques for clinical applications, 18: 15915 (TID-7689(p.15-16))
CUDORS, J., Scintillation β spectrometer, 18: 16347
CUEER, P., Mesic disintegrations of hyperfragments produced in emulsions, 18: 16979
CUEER, P., Nuclear reactions produced by absorption of π^- mesons by light nuclei, 18: 16978
CUMMING, J. B., Radioactivity at high energies, 18: 16598 (BNL-7534 (p.392-8))
CUMMINGS, David B., Stabilized switching ignitron, 18: 16285
CURRAN, T. F., Plasma diagnostic techniques, 18: 17144
CURWEN, Henry Christopher, Improvements in beneficiation of Be ores, 18: 16154
CURZON, A. E., Electron-diffraction patterns from solid D, 18: 16576
CURZON, F. L., Z-pinch dynamics, 18: 17160
CUSHING, J. T., Simple nonlocal model for high-energy scattering, 18: 16784
CUVELLIER, J., Abnormal resistivity of plasma, 18: 17224
CYGANSKI, Andrzej, Complexometric determination of Cs, 18: 15975
CZERNIEJEWSKI, F. R., Matrix treatment of general fissile interaction, 18: 16737 (HW-80213)

D

DAGAI, M., Abnormal resistivity of plasma, 18: 17224
DAGG, Charles P., X irradiation effects on mouse embryos, 18: 15891
DAHLQUIST, J. A., Drift velocity of ions in N, 18: 16060
DAHLSTROM, T. S., Energy- and rate-dependence studies, 18: 16305 (NP-13748)
DALENBERG, J. W., Measurement of fast neutron flux, 18: 16356
DALGARNO, A., Spin change cross sections between H atoms, 18: 16678
DALITZ, R. H., Experimental programs for 1000-Bev and 30-Bev accelerators, 18: 16584 (BNL-7534(p.39-48))
D'AMORE, Mead, Fuel element for nuclear reactor, 18: 17295
D'ANGELO, N., Particle losses of Cs plasma in stellarator, 18: 17228
DANIEL, Richard, Slowing down of charged particles in plasma, 18: 17211
DANIELS, E. A., Surface self-diffusion of adsorbed atoms, 18: 16479 (TID-7689(p.86-9))
DANIELSON, B., Recording of rapidly changing radioactive counting rates, 18: 16311
DANOFSKY, Richard A., Cross-power spectral measurements in training reactor-10, 18: 17330
DANSERCOER, W., Mobility of positive ions in Geiger discharges, 18: 16351
DARBY, J. B., Jr., Technetium compounds with the $MgZn_2$ structure, 18: 16505
DARBY, Thomas D., Transfer of Se-75 across pericardium of dogs, 18: 15804
DARLEY, D. K., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
DARTNELL, J., Electrochemistry of Nb in fused halides, 18: 16032
DATZ, Sheldon, Single-collision scattering of Ar ions from metals, 18: 16667
DAUTERMAN, W. E., SNAP-2 rotational speed control, 18: 17319
(NAA-SR-6310)
DAVEY, C. N., Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)
DAVID, G., Changes in spleen after irradiation, 18: 15822
DAVIES, A. J. S., Time of action of thymus in irradiated adult mouse, 18: 15869
DAVIES, D. K., Secondary ionization processes in He, 18: 16677
DAVIES, K., Doppler studies of ionospheric effects of solar flares, 18: 16644
DAVIES, K., Effects of magnetic disturbance on ionosphere, 18: 16837
DAVIES, K., Study of F2 layer effects by Doppler technique, 18: 16833
DAVIS, Ben K., Method for Fe-55 and Fe-59 assay in mixed plasma preparations, 18: 15980
DAVIS, F. C., Thorium–uranium-233 oxide facility, 18: 16455 (ORNL-3539)
DAVIS, Norma O., Angular and spectral distributions of light emitted from electron-bombarded Ag foils, 18: 16649 (ORNL-3485)
DAVIS, Roger T., Discriminations by irradiated and nonirradiated monkeys, 18: 15849
DAVIS, Roger T., Rhesus monkeys and whole-body radiation with x rays, 18: 15850
DAVOUST, C., Effect of type IV eruptions on absorption, 18: 16834
DAWSON, John M., Breakdown of He in stellarator by magnetic pumping, 18: 17156
DAY, E. A., Radiation-induced changes in milk fat, 18: 15848
DAY, R. B., Mechanical behavior of MgO, 18: 16472 (HR-64-253)
DAY, W. C., Health physics following nuclear excursion, 18: 16242
DAY, W. H., Sterilization of barley malt with γ radiation, 18: 15841
DAYTON, Russell W., Prog. rpt. on civilian applications, 12/63, 18: 17351 (BMI-1659(Del.))
DEAN, P. N., Computer programs for analyzing data, 18: 15737 (LAMS-3034(p.168-79))
DEAN, P. N., Evaluation of K-40 continuum contribution to Cs-137 photopeak in spectrometer, 18: 16302 (LAMS-3034(p.162-7))
DEAN, P. N., Humco II status, 18: 16300 (LAMS-3034(p.143-51))
DEAN, P. N., Thermoluminescent dosimetry with activated LiF, 18: 16303 (LAMS-3034(p.205-23))
DEAN, P. N., Ultracentrifugal sedimentation-velocity molecular weight data for DNA, 18: 15778 (LAMS-3034(p.319-25))
DEAN, P. N., Whole-body γ spectrometer for K and Cs-137, 18: 16301 (LAMS-3034(p.152-61))
DEBAU, D., Changes in immunity due to ionizing rays, 18: 15881
DE BIASE, A., Construction of nuclear-propelled merchant ships, 18: 17321 (RTI/ING(63)-5)
DE BOUARD, X., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
DECHERD, Jonathan F., X-radiation mortality in hypothermic rats, 18: 15887
DECROLY, C., Electrodeposition of Zr–Nb, .18: 16431
DEERING, W., Kinetic and potential energy of an ionized gas, 18: 16662
DE FELICE, J., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
DE GRAAF, A. M., Low-temperature thermal expansion of Ce, 18: 16512
DE HEER, F. J., Electron capture into an excited state by H^+ and He^+, 18: 16705
DE JONGHE, P., Movement of radioelements in soil, 18: 17341
DE KERVENOAEL, Olivier, Improvements in swimming-pool nuclear reactors, 18: 17331
DELABAYE, Beta circularly polarized γ angular correlation in Ag-111, 18: 17018
De La Pena, F. Salamanca
see Salamanca De La Pena, F.
DE LA PENA REGIDOR, P., Iodine-131 and the Freedman reaction, 18: 15821
DELAUNAY-OLKOWSKY, B., Installation of 12-Mev H.V.E.C. tandem at Saclay, 18: 16616
DELAUNAY-OLKOWSKY, B., Source of Li ions, 18: 16615
DEL CASTILLO, G., Magnetic field shaping by superconducting surfaces, 18: 16604 (BNL-7534(p.449-77))
DEL CORSO, G., Sorption of Sr-90 and Cs-137 in wheat, 18: 15761
DELL'ANTONIO, Gianfausto, Field operators for bosons with impenetrable cores. II., 18: 16804
DELLIS, A. N., Whistler-mode propagation in laboratory plasma, 18: 17187

DE LOZIER, Kirby B., Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
DEL TURCO, A. M., Preparation of F-18 in nuclear reactor, 18: 16111
DE LUCA, F., Thyroid capture of I-131 in the rat, 18: 15789
DEMEUR, M., Excitation of collective levels by He-3, 18: 17020
DEMEUR, M., Ionization accompanying disintegration of He-6, 18: 16988
DEMICHELI, R., Angular distribution of fast neutrons scattered by Fe, 18: 17048
DEMUYNCK, J., Lifetime of 2083-kev level in Ce-140, 18: 16990
DEMUYNCK, J., Lifetime of first excited state in Dy-160, 18: 17085
DENECKE, B., Absolute gas counting of tritium. I., 18: 15978
DENHAM, D. H., Health physics following nuclear excursion, 18: 16242
DENISKIN, E. I., Heat exchange in transverse flow around tube bundles, 18: 16175 (NP-13712)
DENISON, J. S., Model of atmosphere and ionosphere in E and F1 regions, 18: 16850
DENNIS, J. A., Neutron dosimetry, 18: 16355
DE PINHO, A. G., Disintegration Pa-231 → Ac-227, 18: 16985
DE PINHO, A. G., Nature of levels of Pa-234, 18: 16987
DEQUENES, Pierre, Process for loading and unloading reactor, 18: 17271
DE RAEDT, J., Behavior of β-γ directional correlation in disintegration of Ho-166, 17011
DE RAEDT, J., Nuclear parameters in β decay of Ga-72 and As-76, 18: 17012
DE RAEDT, J., On the spin of ground state of Pr-144, 18: 17013
DER SARKISSIAN, M., Low-energy π-N scattering, 18: 16777
DERUYTTER, A. J., Ternary fission of U-235 by slow neutrons, 18: 17003
DETRAZ, C., Study of Ca-40, B-11, and B-10 by (p,d) reaction, 18: 17043
DEUTSCH, Beta circularly polarized γ angular correlation in Ag-111, 18: 17018
DEWEY, D. L., Effect of irradiation on the ability of Pseudomonas to synthesize two inducible enzymes, 18: 15871
DEWEY, William C., Use of P-32 to detect neoplasia of G-I tract, 18: 15929
DEY, Arun K., Metal chelates of rare earths. I., 18: 16039
DIBBLE, William E., Design of a Berreman-type point-focusing x-ray monochromator, 18: 16287
DI CASTRO, C., Magnetic field in superconducting films, 18: 16885
DICKERSON, Ronald F., Prog. rpt. on civilian applications, 12/63, 18: 17351 (BMI-1659(Del.))
DICKEY, David D., Neutron meter access tubes, 18: 16201
DIDEIKIN, T. S., Kinetics of reactor leaving the subcritical state, 18: 17283
DIDIER, D., Determination of inelastic cross section of Be, 18: 16966
DIEL VESCOVO, A. V., Dose distribution in grid therapy with 15-Mev electrons, 18: 15943
DIEMINGER, W., Disturbances of pulse radio transmission, 18: 16840
DIETERLY, D. K., Radiochemistry during startup and operation of *Savannah*, 18: 17320 (NSEC-72)
DIETHORN, W., Alpha sources for low-thrust tasks in space, 18: 17324
DIETHORN, W. S., Radiation stability of the Ar clathrate of hydroquinone, 18: 16084
DILLEMANN, H., Determination of inelastic cross section of Be, 18: 16966
DILLI, S., Use of copolymerized celluloses in chromatography, 18: 16145
DILVEN, Saul, Operational method applied to analysis of uniform plasmas, 18: 17146
DIMOCK, D., Particle losses of Cs plasma in stellarator, 18: 17228
DIMOTAKIS, Paul N., Effect of irradiation on recoil phenomena in crystals, 18: 16113
DIMOV, G. I., Betatron with toroidal magnetic field, 18: 16621
DIMOV, G. I., Synchronization of betatron injector with synchrotron, 18: 16624
DIN, G. U., Reactions (He^3,n), 18: 16935(ANL-6848(p.199-207))
DITTNER, P., Prog. rpt. on low-density plasmas, annual, 18: 17121 (TID-20362)
DIX, Donald M., Energy transfer processes in partially ionized two-temperature gas, 18: 16549 (ATN-64(9232)-1)
DIXON, Frank J., Anti-bovine serum albumin formation by transferred hyperimmune mouse spleen cells, 18: 15855
DJIAN, A., Vitamin B_{12} therapy of postradiotherapeutic hematological complications, 18: 15902
DNESTROVSKII, Yu. N., Cyclotron plasma instability. II., 18: 17155
DOBBEN, G., Percutaneous cordotomy for pain, 18: 15734 (ACRH-20 (p.37-46))
DODSON, William S., Irradiation osteomyelitis of the jaws, 18: 15860
DOE, Barbara, Time of action of thymus in irradiated adult mouse, 18: 15869
DOEGE, H.-G., Iron determination in pure Al, 18: 15983
DOI, Kenji, Crystallite size distribution of γ-irradiated polyethylenes, 18: 16099
DOLE, Malcolm, Radiation chemistry of polyethylene. VI., 18: 16093
DOLGOPOLOV, V. V., Cherenkov absorption of "whistles" in plasma cylinder, 18: 17153
DOLGOPOLOV, V. V., Cherenkov damping of h-f plasma oscillations, 18: 17154
DOLIQUE, Jean-Michel, Exchange of movement and energy between electrons and ions, 18: 17210
DOMINGET, R., Zirconium alloys resistant to CO_2, 18: 16439 (CEA-2393)
Dominguez, A. Gonzales
see Gonzales Dominguez, A.
DOMINICI, P., Backscatter sounding during ionospheric storms, 18: 16835
DOMORYAD, I. A., Effects of γ radiation on mechanical properties of Se, 18: 16542
DONALDSON, H. M., Air sampling of Be production facilities, 18: 16236
DONNEAUX, E., Angular distribution in reaction $Li^6(n,t)He^4$, 18: 16965
DORIKENS, M., Lifetime of 2083-kev level in Ce-140, 18: 16990
DORIKENS, M., Lifetime of first excited state in Dy-160, 18: 17085
DORIKENS-VANPRAET, L., Lifetime of 2083-kev level in Ce-140, 18: 16990
DORIKENS-VANPRAET, L., Lifetime of first excited state in Dy-160, 18: 17085
DOUGAL, Arwin A., Plasma diagnostic methods for high-temperature plasma research, 18: 17103 (ARL-64-6)
DOWNEY, J. W., Technetium compounds with the $MgZn_2$ structure, 18: 16505
DOYAS, R. J., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
DRALEY, J. E., Corrosion of Al powder products, 18: 16438 (ANL-6785)
DRAYCOTT, A., Corrosion of Be, BeO, and several steels in CO_2, 18: 16444
DREW, Ruth M., Use of labeled thymidine in cell culture studies, 18: 15802
DRIJARD, D., Pion-nucleon cross section, 18: 16776
DRITS, M. E., Properties and structure of aging Mg alloys, 18: 16495
DRITS, M. E., Softening of Mg alloys, 18: 16496
DROBNIK, Jaroslav, Efficiency of P-32 transmutation in diploid *Saccharomyces cerevisiae*, 18: 15870
DROBYSHEVSKII, E. M., Photoelectric method for scanning Doppler shifts, 18: 16343
DUBROVIN, K. P., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
DUCLOS, J., Excitation of C-12 by scattering of neutrons, 18: 16967
DUGAS, R., Handling and transportation tests of PM-1, 18: 17299 (MND-M-1915)
DUGGER, Gordon S., Reliability of radioisotopic encephalography, 18: 15937
DUHAMEL, F., Experience and practice with film dosimetry, 18: 16257
DUHAMEL, J., Radioprotection and Lazarew's reaction, 18: 16081
DUKE, Thomas W., Radioisotopes in marine biological research, 18: 15748 (TID-7689(p.69-72))
DULL, R. B., Young's modulus of graphite at elevated temperatures, 18: 16186 (WADD-TR-61-72(Vol.XXIII))
DUMOND, Jesse W. M., Design of a Berreman-type point-focusing x-ray monochromator, 18: 16287
DUMONTET, P., Simple model of stripping reaction on Be-9 and N-14, 18: 17053
DUNAWAY, P. B., Weights of cotton rats, 18: 15760
DUNGEY, J. W., Hydromagnetic waves and the ionosphere, 18: 16872
DUNHAM, Charles L., Radiation in our environment, 18: 16212
DUNN, J. W., III, Radiotracer technique for determining stream flow rates, 18: 16391 (TID-7688(p.91-4))
DURASOVA, S. A., Solubility of U peroxide, 18: 16012
DURKEE, R. K., Energy- and rate-dependence studies, 18: 16305 (NP-13748)
DUTAILLY, M.-T., Radiochemical determination of Sr-90 in rain water,

18: 15958 (SCPRI(S)-81)
DUTOV, A. G., Effects of nuclear emission on SiC luminescence, 18: 16122
DUTRANNOIS, J., Nuclear stars in personnel neutron track films, 18: 16262
DUTT, T. L., Analysis of afterglow plasma in Ar, 18: 17234
DVIR, M., Microwave attenuation by shocked-heated air, 18: 16565
DWYER, Harry A., Mean flow characteristics of gas-solid suspensions, 18: 16176 (NYO-2930-1)
D'YACHKOV, V. G., Morphological changes in cat brain following radiation injury, 18: 15818 (JPRS-23544)
DYNE, P. J., Radiation chemistry of cyclohexane. VI., 18: 16082
DZHELEPOV, B. S., Decay scheme of radioactive nuclei $A \geq 100$, 18: 17099
DZOGA, Kotti, Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689(p.17-20))

E

EASTABROOK, J., Titanium–Nb system, 18: 16508
EBERSTADT, Peter L., Slow absorption curves of I-131 from G-I tract, 18: 15791
EBSCHNER, Karl-Jochen, Radiation necrosis of the cerebellum, 18: 15830
ECKER, G., Lowering of ionization energy for plasma, 18: 17208
ECKER, G., Thermal instability of plasma column, 18: 17229
ECKERD, J. W., Effect of γ radiation on anthracite, 18: 16523 (BM-RI-6391)
ECKHARDT, W. O., Research on ion beam formation from plasma sources, 18: 17240
ECKHARTT, Dieter, Magnetic surfaces in a stellarator, 18: 17178
EDELEN, Dominic G. B., Material momentum-energy tensors, 18: 16571
EDELSON, D., Drift velocities of ions in N, 18: 16058
EDENFIELD, C. E., Specialized toroidal pressure vessel, 18: 16164 (ERR-AN-174)
EDWARDS, J. J., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
EFENDIEV, G. Kh., Leaching-out U and Ra from clays, 18: 16133
EGAN, R. D., Influence of sudden ionospheric disturbances, 18: 16836
EGAN, R. D., Intense polar cap absorption events, 18: 16827
EGELAND, Alv, Influence of solar disturbances on vlf radio waves, 18: 16830
EGGLETON, A. E. J., Removal of I from gas streams, 18: 16033
EGIAZAROV, B. G., Apparatus for measuring angular distribution of annihilation radiation of positrons, 18: 16304 (NP-13693)
EHRLICH, Margarete, Photographic film for personnel dosimetry, 18: 16256
EIBER, H., Identification of ions in diluted gases, 18: 16059
EICHELBERGER, J. F., Prog. rpt., 5/63, 18: 16376 (MLM-1157)
EIDSON, W. W., Inelastic scattering of α particles from C-12, Mg-24, Si-28, and Fe-56, 18: 16928 (ANL-6848(p.153-8))
EISENMANN, Dale R., Response in rat incisor dentin to injected Sr, 18: 15792
EJIRI, Hiroyasu, Gamma rays from reaction $Si^{30}(p,\gamma)P^{31}$, 18: 17059
EL-BAZ, E., Polarization of protons in stripping reaction, 18: 16994
ELDRIDGE, James S., Evaluation of I-125 measurement techniques for clinical applications, 18: 15915 (TID-7689(p.15-16))
ELDRIDGE, James S., Nondestructive method for determination of Cf-252, 18: 15969
ELENA, A., Solar effects on radio wave propagation, 18: 16838
ELFORD, M. T., Ratio of drift speed to diffusion coefficient for quasi-thermal electrons, 18: 16724
ELLIOT, A. Grant, High-temperature behavior of $MoSi_2$ and Mo_5Si_3, 18: 16499
ELLSWORTH, Elmer I., Radiation-induced cable currents. I., 18: 16522 (AD-429954)
ELSNER, B., Elastic scattering (π^+-p and p-p), 18: 16789
ELVING, Philip J., Rotating disk electrode, 18: 16004 (TID-20339)
ELWERT, G., Theory and measurements of x-ray emission of the sun, 18: 16641
EMERSON, L. C., Angular and spectral distributions of light emitted from electron-bombarded Ag foils, 18: 16649 (ORNL-3485)
ENGELKEMEIR, D. W., Half-life determination of Rn-220, 18: 17086
ENGLANDER, O., Vacuum-operated instrument for handling Ra tubes, 18: 15924
ENGLANDER-GOLDEN, Paula, Ionization of atoms and diatomic molecules by electron impact, 18: 16695
EPHERRE, M., Production of Li-6 and Li-7 fragments in elements, 18: 16977
EPSTEIN, Harold, Method to evaluate effective threshold foil parameters, 18: 16367
EPSTEIN, L. M., Stimulated emission of γ radiation, 18: 16952 (TID-20313)
EPSTEIN, Lee F., Some infinite sums involving zeros of $J_0(X)$, 18: 16418
EREMENKO, Yu. A., Argon-filled spark chambers, 18: 16337
EREMENKO, Yu. A., Investigation of ion drift in Wilson chamber by spark chamber, 18: 16335
ERMAKOV, A. I., Cherenkov absorption of "whistles" in plasma cylinder, 18: 17153
ERMAKOV, A. I., Cherenkov damping of h-f plasma oscillations, 18: 17154
ERMATOV, S. E., Effects of h-f discharge on adsorption properties of silica gels and zeolites, 18: 16117
ERMATOV, S. E., Effects of γ radiation on adsorptive properties of synthetic zeolites, 18: 16118
ERMISCHER, W., Uranium dioxide oxidation, 18: 16037
ERSKINE, John R., Study of (d,p) reactions on targets of W-182, W-184, and W-186, 18: 16916 (ANL-6848(p.86-97))
ESCHENBACH, R. C., Characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
ETEMAD, Akbar, Penetration of thermal neutrons in empty cylindrical channels through hydrogeneous media, 18: 17249 (EIR-60)
ETIENNE-AMBERG, L., Knight shift in Be, 18: 16515
EVANS, A. M., Osteoradionecrosis of the mandible, 18: 15921
EVANS, E. W., Physics of pulsed MHD generators, 18: 16743 (MHD-646)
EVANS, S. D., Rubidium-86 diffusion in soil and kaolinite systems, 18: 16199
EVANS, S. D., Uptake of Rb-86 by corn, 18: 15801
EVDOKIMOV, V. M., Effect of electric field on NMR, 18: 17065
EVERETT, N. B., Effect of irradiation on long-lived lymphocyte of the rat, 18: 15872
EWING, R. A., Filter efficiency in removal of oil mist from compressed air, 18: 16388 (TID-7688(p.78-80))
EWING, William O., Jr., Blast loading of outer containment structures for reactors, 18: 17258 (BRL-Memo-1530)

F

FACCHINI, U., Statistical model analysis of (n,α) reactions. II., 18: 17058
FAINBERG, Ya. B., Excitation of oscillations by electron beam in plasma, 18: 17112 (NP-13697)
FAIRAND, Barry, Method to evaluate effective threshold foil parameters, 18: 16367
FAJANS, Kasimir, Change of binding type in series of monohydrides, 18: 16028
FALCOZ, A., Polarized deuterons of Saclay cyclotron, 18: 16617
FALLIEROS, S., Isobaric analogue states and intermediate resonances in nuclei, 18: 16926 (ANL-6848(p.143-6))
FANG, P. H., Symmetry relation in relaxation dispersions, 18: 16567
FARAGGI, H., Inelastic scattering of 44-Mev α particles in medium-weight nuclei, 18: 16925 (ANL-6848(p.137-42))
FARR, Lee E., Effects of heavy high-energy charged particles. I., 18: 15826
FARR, Lee E., Effects of heavy high-energy charged particles. IV., 18: 15829
FARRAR, J. P., Reactivity behavior at Indian Point, 18: 17312
FASOLO, G. B., Determination of trace metals in petroleum, 18: 15968
FAY, James A., Comments on flexure of plasma conductor, 18: 17181
FEARN, D. G., Conduction between electrodes in shock-heated Ar, 18: 17222
FEDDEMA, J., Ratio of requisite radiation to available information, 18: 15930
FEDEROV, V. M., Recovery time of Wilson chambers, 18: 16333
FEDEROV, V. M., 150-Liter Wilson chamber, 18: 16334
FEDORCHENKO, V. D., High-frequency oscillations of plasma in magnetic field, 18: 17109 (NP-13612)
FEDORENKO, N. V., Energy losses in single collisions of atomic particles, 18: 16710
FEELY, Herbert, Prog. rpt. on high-altitude balloon sampling, 2/64, 18: 16203 (NYO-10496)

FEIGE, Y., Secondary radiation protection standards, 18: 15908
FEIGELSON, R. S., Preparation and properties of Ca and Sr scandates, 18: 16015
FEIN, A. E., Heavy-particle path lengths in cylinders, 18: 16316
FEINENDEGEN, L. E., Mitotic delay in erythroblasts of the dog, 18: 15874
FEIX, Marc, Correlation function in plasma outside equilibrium, 18: 17198
FEIX, Marc R., Quantum mechanical treatment plasma correlations, 18: 17197
FEJER, J. A., Hydromagnetic stability at a fluid velocity discontinuity, 18: 16564
FENDER, F. G., Direct reaction contributions to fluctuating reaction cross sections, 18: 16938 (ANL-6848(p.228-9))
FENNEMA, J. W. R., Polarization of Lyman α radiation emitted by H, 18: 16714
FER, Francis, Evolution of particle accelerators, 18: 16613
FERGUSON, Hayden, Neutron meter access tubes, 18: 16201
FERGUSON, John L., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
FERNANDEZ, B., Inelastic scattering of 14.1-Mev neutrons by S-32, 18: 16972
FERRARIS, M. M., Determination of alkali and alkaline earth metals, 18: 15957 (RT/PROT(63)-13)
FERRARO, V. C. A., Solar eclipse and solar flare effects in the F2 region, 18: 16643
FERRELL, J. K., Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))
FETTWEIS, P., Decay scheme of 42-sec Rh-104, 18: 16989
FIAM, B., Changes in spleen after irradiation, 18: 15822
FIELD, H. C., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7451)
FIELD, L., Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)
FIELDS, H., Relaxation rate of electrons to equilibrium, 18: 17233
FILIPCZAL, Wieslaw, Computer for reactor calculations, 18: 17250 (PAN-O-117)
FINCH, C. B., Fusibility diagram for NaF–KF–ZrF_4 system, 18: 16008 (ORNL-tr-31)
FIORE, C., Effect of x rays on movements of Na in human erythrocytes, 18: 15873
FIORE-DONATI, L., Action of isologous bone marrow on radiation leukemogenesis, 18: 15899
FIORENTINI, A., Positron annihilation in alkali halides, 18: 16665
FIQUET-FAYARD, Florence, Formation of multiple charged ions by Auger effect, 18: 16698
FISCHER, Heinz, Afterglow tails and stability of high-density nanosecond arc channels, 18: 17235
FISCHER, Jack, Fluid-bed fluoride volatility processes. V., 18: 16076 (ANL-6812)
FISCHER, S., Uptake of Fe-59 by tibia of new-born rats, 18: 15797
FISHMAN, Frank J., Jr., Electrode nonuniformities magnetic field in MHD generators, 18: 16741 (BSD-TDR-63-248)
FITCH, Frank W., Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689(p.17-20))
FITE, W. L., Electron collisions with atomic and molecular O, 18: 16694
FITZGIBBON, George C., Solution calorimeter, 18: 16276 (LA-3031)
FLANAGAN, Ted B., Radiation-induced solid-state crystallization, 18: 16096
FLICKER, Michael, Asymptotic exchange coupling of two H atoms, 18: 16669
FLOCK, W. L., Geomagnetic agitation and overhead aurora, 18: 16860
FLORCZAK, J., Eigenvalues for the atomic field, 18: 16658
FLOWERS, B. H., Pairing correlations in infinite systems, 18: 17084
FLUIT, J. M., Range of focused collision sequences in Cu, 18: 16672
FLUIT, J. M., Sputtering of Cu by 20-kev noble gas ions, 18: 16673
FOELDES, Janos, Dosimetry of the isotope I-131, 18: 15941
FOELDIAK, Gabor, Radiation chemical thermal decomposition of hydrocarbons, 18: 16116
FOLDY, L. L., Remarks concerning reciprocity in quantum mechanics, 18: 16802
FOLKESTAD, K., H-f communications during polar radio blackouts, 18: 16828
FOMENKO, G. P., Betatron with toroidal magnetic field, 18: 16621
FONG, Peter, Theory of fission and kinetic energy distribution, 18: 17100
FONG, R., Relativistic particle dynamics and the S matrix, 18: 16769
FONTANA, Mario H., Foam suppression of radioactive iodine and particulates, 18: 16128 (NYO-9324)
FORD, M. R., Estimates of $(MPC)_w$ for Sr-90, Sr-89, and Sr-85, 18: 15907
FORD, M. R., Hazard of radioactive materials, 18: 16241
FORRESTAL, Lloyd J., ESR studies of irradiated polypropylene, 18: 16097
FORT, E., Fluctuation of cross section of (n,α) on Si, 18: 16971
FOSTER, Ellis L., Jr., Tensile fracture and microstructure of U, 18: 16466 (BMI-1664)
FOSTER, L. M., Tritium decoration of defect structures in Al, 18: 16478 (TID-7688(p.44-9))
FOUCHER, R., Disintegration Pa-231 → Ac-227, 18: 16985
FOUCHER, R., Lifetime of first excited level of Gd-152, 18: 16986
FOUCHER, Roger, Quadrupolar deformations of heavy nuclei, 18: 16949 (NP-13735)
FOWLER, C. F., Influence of sugars on radiation sensitivity of catalase, 18: 15900
FOWLER, E. C., Possible detection technique, 18: 16295 (BNL-7534 (p.318-23))
FOX, J. G., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
FRANK, D., Multi-time-scale formalism in weak coupling theory, 18: 16817
FRANK, W. M., Exchange magnetic moment in three-body nuclei, 18: 17074
FRANKS, A., Electron probe microanalysis of light elements, 18: 15986
FRATZSCHER, W., Temperature field calculation, 18: 16185
FRAUTSCHI, S. C., Scattering at very high energies, 18: 16747 (BNL-7534(p.49-80))
FRAUTSCHI, S. C., Strong-interaction theory studied at high energies, 18: 16748 (BNL-7534(p.81-2))
FRAYSSE, G., Fission cross section of Pu-239, 18: 17002
FRAZER, Jack W., Determination of O in organic compounds, 18: 15963 (UCRL-7618)
FREDERIKSE, H. P. R., Electronic transport in Sr titanate, 18: 16045
FREEMAN, A. J., Theory of spin-orbit coupling in atoms. III., 18: 16664
FREEMAN, Barbara M., Radiation for elimination of Salmonellae from foods, 18: 15854
FREEMAN, D. E., Dipole moments of excited electronic states of molecules, 18: 17352 (CONF-417-6)
FREEMAN, R., Excited levels of Na-23 following α reactions on F-19, 18: 17001
FREEMAN, R., Reactions (d,p) and (d,d) on C-12, 18: 16991
FREEMAN, R., Study of levels of Be-8, 18: 17023
FREESTON, I. L., Double sheath at discharge constriction, 18: 17237
FREILING, E. C., Effect of radionuclide fractionation on exposure dose rate from local fallout, 18: 16234 (USNRDL-TR-715)
FREUND, Peter G. O., Octet-octet mixing, 18: 16793
FRICK, G., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000
FRICKE, Martin P., Elastic and inelastic scattering of 40-Mev protons, 18: 16924 (ANL-6848(p.130-6))
FRIED, Ilana, Rotating disk electrode, 18: 16004 (TID-20339)
FRIEDMAN, H., Ionospheric constitution and ionizing radiations, 18: 16733
FRIEDMAN, H., Ionospheric constitution and ionizing radiations, 18: 16848
FRIEDMAN, Lionel, Steady diamagnetic susceptibility of small systems, 18: 16812
FRIES, B. A., Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689(p.128-33))
FRIES, B. A., Leak testing in refineries with radioisotopes, 18: 16389 (TID-7688(p.80-3))
FRIES, B. A., Residence time of particles in rotary kiln, 18: 16002 (TID-7689(p.133-6))
FRIGERIO, G. E., Cross section for production of H atoms in the 2S state, 18: 16704
FRITZ, G. T., Oligonucleotide synthesis, 18: 15779 (LAMS-3034(p.329-49))
FRITZ, James S., Anion exchange separation of Ca and Sr, 18: 16132

FRUHMAN, C. J., Uptake of Fe-59 by tibia of new-born rats, 18: 15797
FUJITA, J., Particle losses of Cs plasma in stellarator, 18: 17228
FUKAI, Yuh, Gradient-elastic tensor of alkali halide crystals, 18: 16562
FUKATKO, T., Probes for adjusting the cyclotron beam, 18: 16618
FUKUSHIMA, N., Extra-terrestrial corpuscular streams, 18: 16871
FULWYLER, M. J., Effect of ashing temperature on Cs and K content of bone, 18: 15953 (LAMS-3034(p.201-4))
FULWYLER, M. J., Metabolism of radioiodine in children and adults, 18: 15775 (LAMS-3034(p.187-200))
FULWYLER, M. J., Retention of Cs-137 by adults, 18: 15774 (LAMS-3034(p.184-6))
FUNSTEN, H. O., Selection rules in $Ti^{48}(p,p^1)$ inelastic scattering, 18: 16930 (ANL-6848(p.168-71))
FURCHNER, J. E., Distribution of Cs-137 in mice and dogs after chronic exposure, 18: 15766 (LAMS-3034(p.41-8))
FURCHNER, J. E., Effect of exercise on excretion of Cs-137, 18: 15765 (LAMS-3034(p.34-40))
FURCHNER, J. E., Effect of temperature on retention of Sr in mice, 18: 15770 (LAMS-3034(p.65-72))
FURCHNER, J. E., Metabolism of Mn-54, 18: 15767 (LAMS-3034(p.49-52))
FURCHNER, J. E., Potassium-40 and Cs-137 levels in beagles, 18: 15771 (LAMS-3034(p.73-5))
FURCHNER, J. E., Retention of intravenously administered Cs-132, 18: 15764 (LAMS-3034(p.21-33))
FURCHNER, J. E., Retention of Zr-95 in mice, 18: 15768 (LAMS-3034 (p.53-8))
FURCHNER, J. E., Retention of intravenously administered Be-7 by rats, 18: 15769 (LAMS-3034(p.59-64))

G

GABBARD, James L., Vapor-liquid equilibrium of the UF_6—decafluorobis-(trifluoromethyl) cyclohexane, C_8F_{18}, system, 18: 15995 (K-271)
GABRIANOVICH, B. N., Heat transfer in liquid metals flowing through pipes, 18: 16173 (NP-13656)
GABRIEL, John, New methods for reduction of group representations, 18: 16806
GAILLEDREAU, C., Ground disposal injection of radioactive sludge, 18: 17346
GAILLEDREAU, Claude, Kinetics of Sr-90 retention, 18: 17343
GAILLEDREAU, G., Underground movement of radioisotopes, 18: 16208
GALE, A. J., Activation analysis with Van de Graaff neutron sources, 18: 15956 (NP-13762)
GALIMBA, Frank B., Radiation-induced chlorination of toluene by stannic chloride, 18: 16094
GALLIEN, Odette, Radioinduced modifications to lipids, 18: 15813 (NP-13733)
GALLMANN, A., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000
GAO, Chong-shou, Formulas for masses of π-π resonances, 18: 16799
GARCIA, E. E., Bibliography of analytical methods for alkali metals, 18: 15964 (WCAP-2540)
GARD, J., Birefringence in irradiated polyethylene, 18: 16098
GARDNER, J. W., Progress in thermionic conversion, 18: 17254
GARDNER, R. P., Alpha gage system for measurement of gas density, gas pressure, and thin film thickness, 18: 16383 (TID-7688(p.7-13))
GARDNER, R. P., Frequency response testing of aqueous mixing systems by radiotracer, 18: 16001 (TID-7689(p.126-8))
GARDNER, R. P., Maximum allowable radiotracer injections for flow rate measurements in public streams, 18: 15905 (TID-7689(p.34-7))
GARDNER, R. P., Radiotracer technique for determining stream flow rates, 18: 16391 (TID-7688(p.91-4))
GARELIS, E., Prog. rpt. on pulsed neutron application to power reactor startup, 7–9/63, 18: 17297 (GEAP-4388)
GARIN, A., Study of reaction $Li^8 + Li^7 \rightarrow \alpha + Be^9$, 18: 17008
GARLICK, G. F. J., Luminescence in solids, 18: 16577
GARNETT, J. L., π-Complexes in catalytic tritiation, 18: 16040
GARNETT, J. L., Use of copolymerized cellaloses in chromatography, 18: 16145
GARRALDA, Barbara B., Anion exchange separation of Ca and Sr, 18: 16132
GARRETT, Edward R., Kinetics of steroid effects on Ca-47 dynamics in dogs. I., 18: 15795
GARRON, J. P., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
GARRON, J. P., Inelastic scattering of 155-Mev protons on light nuclei, 18: 17070
GARVEY, G. T., Excitation of $T = T_z + 2$ states, 18: 16923 (ANL-6848 (p.125-9))
GARVEY, G. T., Selection rules in $Ti^{48}(p,p^1)$ inelastic scattering, 18: 16930 (ANL-6848(p.168-71))
GASHEV, M. A., Characteristics of "Tokomak-III," 18: 17111 (NP-13696)
GASSMANN, G. J., Conference on solar disturbances of communications, Naples 5/61, 18: 16822
GATTI, G., Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)
GAUVIN, Henri, Reactions (p,2pxn) on Th-232 at 30 to 120 Mev, 18: 16976
GEL, E. P., Ion source for neutron tubes with controlled ion current, 18: 16904
GEL'D, P. V., Concentration region of homogeneity of carbides of transition metals, 18: 16483 (AEC-tr-6374)
GEMMELL, D. S., Reactions (d,n) on Fe-54 and Ni-58, 18: 16917 (ANL-6848(p.98-103))
GEOFFRION, B., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
GERETH, Reinhard K., Preparation of Si for study of radiation damage, 18: 16528 (SC-DC-64-346)
GEROSA, A., Joint AN/CNEN/NPPC irradiation program, 18: 17328
GERSHON-COHEN, Jacob, Effect of adrenal irradiation upon aldosterone production in the rat, 18: 15842
GERSTEIN, B. C., Thermal study of the W bronzes. I., 18: 16030
GERSTEIN, I. S., Moravcsik's principle of equivalence, 18: 16785
GERVAT, A., Calculation of equation of state of H, 18: 16056
GESHKO, E. I., Roentgen interferences of W over range of 300 to 1100°K, 18: 16687
GESI, Kozuo, Infrared absorption spectrum of γ-irradiated $NaNO_3$, 18: 16100
GETOFF, N., Retention and annealing reactions in dichromates, 18: 16114
GHERSINI, G., Chromatography on alkali metals and alkaline earths, 18: 16141
GIAMBIAGI, J. J., Divergences of quantum field theories, 18: 16808
GIBBON, R. B., Joint AN/CNEN/NPPC irradiation program, 18: 17328
GIBBS, W., Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
GIBBS, William, Rapid screening method for detecting abnormal plasma vitamin B_{12}, 18: 15914 (TID-7689(p.11-14))
GIBSON, Faison P., Finite-range n-p potential in Coulomb stripping reactions, 18: 16911 (ANL-6848(p.43-50))
GIBSON, G., Plasma behavior in the Bumpy Torus, 18: 17171
GIBSON, J. W., Superconductivity in Ge telluride, 18: 16888
GILBODY, H. B., Positive ion stripping studies at 100–450 kev, 18: 16712
GILES, Robert H., Jr., Prog. rpt. on effects of insecticide on ecology of fauna, 12/60–11/63, 18: 17362 (TID-20355)
GILLET, Vincent, Effective two-body forces for C-12 and O-16, 18: 17054
GILMORE, J. T., Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689 (p.128-33))
GILSON, V., Mercury arc discharge in a magnetic field, 18: 17142
GINDLER, J. E., Half-life determination of Rn-220, 18: 17086
GINTHER, J., Thermoluminescence methods in personnel dosimetry, 18: 16361
GIORGINI, A., High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)
GIRLIN, Joseph N., System to obtain data on population exposure to x rays, 18: 16248
GITTUS, J. H., Effects of dilute alloying additions on grain size of U, 18: 16509
GLADROW, Elroy Merle, Radiochemical process for transformation of hydrocarbons, 18: 16079 (CEA-tr-A-1411)
GLASSER, Stanley R., Placental dysfunction as cause of prenatal radiation death, 18: 15894
GLASSFORD, Kenneth F., Intraoral findings in humans after exposure to fallout. I., 18: 15843
GLENDENNING, Norman K., Two-nucleon stripping reactions, 18: 16934 (ANL-6848(p.188-98))

GLIDDON, J. E. C., Solar eclipse and solar flare effects in the F2 region, 18: 16643
GLOERSEN, Per, Characteristics of two-stage repetitively fired coaxial gun, 18: 17140
GLOVER, R. N., Reactions Mg^{26}(d,p) Mg^{27} and Mg^{26}(t,d) Mg^{27}, 18: 16918 (ANL-6848(p.104-5))
GLOVER, R. N., Stripping and pickup reactions on C-12, C-13, and C-14, 18: 16914 (ANL-6848(p.70-8))
GOCHENOUR, William S., Jr., Modification of anthrax by radiation, 18: 15858
GOLANT, V. E., Charged-particle diffusion in magnetic field, 18: 17227
GOLD, Marvin, Deoxyribonucleic acid polymerase in L cells. II., 18: 15831
GOLDAN, P. D., Collisional processes in He plasmas, 18: 17193
GOLDBERG, I. H., Inhibition of RNA polymerase by 6-azauridine triphosphate, 18: 15751
GOLDBERG, V. Z., Magnetic β spectrograph with wide focus, 18: 16332
GOLDEN, K. E., Simulation of thin plasma sheath, 18: 17139
GOLDHABER, Gerson, Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
GOLDHABER, Sulamith, Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
GOLDING, R. M., ESR study of NO_2 and NO_3 in irradiated Pb nitrate, 18: 16087
GOLDSMID, H. J., Non-linear resistance in Bi, 18: 16660
GOLDSTEIN, G., Liquid scintillators using 1-methylnaphthalene, 18: 16317
GOLDSTEIN, L., Collisional processes in He plasmas, 18: 17193
GOLDSTEIN, Mark K., Radiation-induced solid-state crystallization, 18: 16096
GOLUB, V. S., Converter-switch apparatus for pulse extraction from Geiger counters, 18: 16345
GOLUBEV, V. I., Group cross sections of nuclear reactions used for recording neutrons, 18: 16947 (NP-13661)
GOMBOSHI, E., Scattering constant K_s in NIKFI-R emulsions, 18: 16339
GOMES, A. A., Low-temperature thermal expansion of Ce, 18: 16512
GONZALES DOMINGUEZ, A., Divergences of quantum field theories, 18: 16808
GONZALEZ C., R., Working conditions and radiation levels at mines, 18: 16240
GONZALEZ DEL CAMPO, R., Dosimetry practice in the "Junta de Energia Nuclear," 18: 16268
GOODMAN, D. E., FICS—program for few-group constants within KARE system, 18: 16893 (KAPL-M-6119)
GORDEEV, I. V., Constants in nuclear physics. Handbook, 18: 17255
GORDEEV, Yu. S., Energy losses in single collisions of atomic particles, 18: 16710
GORIZONTOV, P. D., CNS changes in experimental radiation sickness, 18: 15836
GORLICH, P., Coloration layer in deuteron-irradiated LiF crystals, 18: 16108
GORODETSKII, A. A., Anti-radiation properties of gallates, 18: 15904
GORODETSKII (GORODETSKIY), A. A., Antiradiation properties of gallates, 18: 15896 (JPRS-23834)
GORODETZKY, S., Double γ emission in monopolar transitions, 18: 16999
GORODETZKY, S., Electromagnetic transition probabilities in O-16, 18: 16998
GORODETZKY, S., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000
GORODETZKY, S., Excited levels in F-19 by study of $O^{18}(p,\alpha_0)N^{15}$, 18: 17030
GOROWITZ, Bernard, Characteristics of two-stage repetitively fired coaxial gun, 18: 17140
GORSHKOV, G. V., Neutron radiation of natural formations, 18: 16209
GORTATOWSKI, Melvin J., Synthesis of ring-labeled L-thyroxine-C^{14}, 18: 16074
GOSS, James A., Using $C^{14}O_2$ for C fixation studies with pollen, 18: 15785 (TID-7689(p.68-9))
GOTTSCHALK, Alexander, Suppression of pituitary function in diabetic retinopathy, 18: 15927
GOULDAMACHVILI, A. I., Charge exchange between ions and atoms of alkaline and alkaline-earth metals, 18: 16727
GRABAR, Pierre, Symposium on immunopathology, La Jolla, Calif., 1/63, 18: 15754
GRADSZTAJN, E., Intranuclear cascades by Monte Carlo method, 18: 16974
GRADSZTAJN, E., Production of Li-6 and Li-7 fragments in elements, 18: 16977
GRAFF, J., Excited levels in F-19 by study of $O^{18}(p,\alpha_0)N^{15}$, 18: 17030
GRAIKOSKI, John T., Sterilization of barley malt with γ radiation, 18: 15841
GRANT, W. B., Alpha monitoring procedures for EBR-I Mark IV elements, 18: 17309
GRATTAN-SMITH, P., Pediatric radiology using short exposure times, 18: 15940
GRATTON, R., Measurement of large impulse currents in Cariddi experiment, 18: 17120 (RT/FI(63)-49)
GRAUBY, A., Retention of Ru-106 + Rh-106 in soils, 18: 17345
GRAUBY, A., Study of radioelement migration in soils, 18: 16216
GRAUL, E. H., Biological methods in personnel dosimetry, 18: 16259
GRAY, E., Prog. rpt. on low-density plasmas, annual, 18: 17121 (TID-20362)
GREEN, Brian Noel, Improvements relating to mass spectrometers, 18: 16289
GREEN, J. H., Radium-226 content of natural waters and coal in New South Wales, 18: 16211
GREEN, M., Angular distribution of characteristic x radiation, 18: 16685
GREEN, Margaret W., Labeling of human globulin with I-124, 18: 15933
GREENBERG, Elliot I., Low-dose fluororadiography, 18: 15936
GREENBERG, Joseph, Resistance of *E. coli* S mutants to proflavine, 18: 15844
GREENBERG, S., Corrosion of Al powder products, 18: 16438 (ANL-6785)
GREENE, N. D., Prog. rpt. on high acceleration field heat transfer for SNAP, 9–11/63, 18: 16177 (TID-20133)
GREENE, N. D., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
GREENFIELD, Moses A., Current status of radiation hazards, 18: 16251
GREENSTOCK, C. L., Pulse radiolysis using constricted air spark light source, 18: 16101
GREENSTREET, B. L., Instantaneous collapse and creep buckling of shells, 18: 16159 (ORNL-3555)
GREENWOOD, A. N., Motion of ions in cathode sheath of an arc, 18: 17239
GREGORY, N. L., Protected radioactive source for gas chromatographic detectors, 18: 16319
GRENACS, J., Nuclear parameters in β decay of Ga-72 and As-76, 18: 17012
GRENACS, L., Behavior of β-γ directional correlation in disintegration of Ho-166, 18: 17011
GRENACS, L., On the spin of ground state of Pr-144, 18: 17013
GREY, Jerry, Radiation probe for arcjet measurements, 18: 17138
GRIEGER, G., Particle losses of Cs plasma in stellarator, 18: 17228
GRIFFEN, A. B., Chromosomal aberrations in pre-supermatocytic cells of irradiated male mice. II., 18: 15893
GRIFFIN, D. S., Inelastic deflection of fuel plates, 18: 17292
GRIFFIN, James Edward, Photoneutron resonances in O-16, 18: 16943 (IS-676)
GRIFFITH, John Q., Jr., Effect of adrenal irradiation upon aldosterone production in the rat, 18: 15842
GRIFFITH, Martin G., Effect of adrenal irradiation upon aldosterone production in the rat, 18: 15842
GRIFFITHS, G. M., Gamma rays from 14.4-Mev level in Be-9, 18: 17101
GRIGOROV, N. L., Cosmic radiation beyond atmosphere, 18: 16732 (FTD-TT-64-90(p-163-76))
GRIMMETT, E. S., Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
GROSS, Paul, Pulmonary deposition and retention of inhaled aerosols, 18: 15806
GROSS, R. A., MHD species separation in gaseous nuclear rocket, 18: 17323
GROSS, Robert A., Continuum radiation behind blast wave, 18: 16648 (NP-13739)
GROSSETTI, E., Relaxation-time determination in quadrupolar resonance, 18: 16041
GROSSMANN, O., Iron determination in pure Al, 18: 15983
GROVE, G. R., Prog. rpt., 5/63, 18: 16376 (MLM-1157)
GROW, R. W., Microwave diagnostics of plasmas, 18: 17143

GROZIER, J. D., Corrosion and H absorption of Zy-2, 18: 16440 (WAPD-283)

GRYZINSKI, Michal, Coulomb interaction and its application to atomic collisions, 18: 16711

GUDERJAHN, C. A., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)

GUENTHER, R. L., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)

GUPTA, K. Das, X-ray scattering from single crystals, 18: 16551 (TID-20364)

GUREVICH, L. G., Radiation-induced destruction of linear polymers, 18: 16123

GURNEY, C. W., Method for investigation of stem-cell kinetics, 18: 15833

GUSTOV, G. K., Characteristics of "Tokomak-III," 18: 17111 (NP-13696)

GUYTON, Arthur C., Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))

GVALADZE, Yu. S., Plasma properties in theta pinch, 18: 17159

GYGAX, S., Superconducting In–Pb alloys, 18: 16884

GYOREY, G. L., Radiotracers for lead detection in Saturn vehicle, 18: 16392 (TID-7688(p.95-7))

H

HAAG, J., Strongly populated levels of $(d_{3/2})^{\frac{1}{2}}$ and $(f_{7/2})^{\frac{1}{2}}$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))

HAASS, W. P., Spent-fuel shipping cask, 18: 16225 (MND-M-1856)

HABERMAN, J., Adsorption isotherm of surfactant on organic substrate, 18: 16384 (TID-7688(p.31-7))

HAENNY, Charles, Emission of neutrons on rupture of U nucleus, 18: 16957 (AEC-tr-6371)

HAGEDORN, F. B., Silsbee-limit critical currents in a 1700A film of Sn, 18: 16889

HAGEN, G., Research on ion beam formation from plasma sources, 18: 17240

HAGHIRI, F., Removal of radioactive Sr from H_2O, 18: 16249

HAISSINSKY, M., Polonium, 18: 15946 (MLM-1165(Tr))

HALE, D. B., Electronic measurement of cellular volumes. IV., 18: 15739 (LAMS-3034(p.235-52))

HALE, D. B., Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))

HALE, D. B., Electronic measurement of cellular volumes. VI., 18: 15741 (LAMS-3034(p.261-9))

HALE, D. B., Electronic measurement of cellular volumes. VII., 18: 15742 (LAMS-3034(p.270-8))

HALL, D. F., Ion beam neutral component determinations, 18: 16581

HALL, R. B., Plasma acceleration by field gradients, 18: 17151

HALLEY, Pierre, Sudden ionospheric disturbances. Verified effects and probable causes, 18: 16823

HALPERN, Jack, Kinetics of reduction of Co(III) complexes, 18: 16018

HALTEMAN, Eber K., Nuclear reactor fuel members, 18: 16449

HALVAS, J., Scintillating plastics, 18: 16366

HALVAS, J., Working conditions and radiation levels at mines, 18: 16240

HAM, Pham Khac, Scattering of 14-Mev neutrons by C-12: excited states, 18: 16968

HAMMER, Charles L., Photoneutron resonances in O-16, 18: 16943 (IS-676)

HANKINS, Dale E., Comparison of neutron dose rates, 18: 16299 (LAMS-2997)

HANLE, W., Measurement of external radiation doses, 18: 16260

HANNA, John W., Blast loading of outer containment structures for reactors, 18: 17258 (BRL-Memo-1530)

HANSBURY, E., Oligonucleotide synthesis, 18: 15779 (LAMS-3034 (p.329-49))

HANSEN, O., Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))

HANSEN, Siegfried, Improvements in or relating to plasma accelerators, 18: 17241

HANZEL, Slavko, Equipment for continuously recording γ radiation, 18: 16312

HARAR, S., Inelastic scattering of 14.1-Mev neutrons by S-32, 18: 16972

HARDEN, R. McG., Parathyroid function after I-131 therapy, 18: 15926

HARDIGREE, Alice A., Sensitivity to radiation in *E. coli*, 18: 15846

HARDMAN, A. C., Civil defense health programs in Canada, 18: 16246

HARGETT, A. E., Cesium-137 body burdens of control subjects, 18: 16224

HARMER, D. S., Mobilities of mass-indentified ions in N, 18: 16057

HARPER, J. D., Jr., Effect of solar disturbances on Ionosphere Reflectio, 18: 16846

HARPER, P. V., Nuclear needle for neurosurgery, 18: 15912 (ACRH-20(p.25-36))

HARPER, P. V., Percutaneous cordotomy for pain, 18: 15734 (ACRH-20 (p.37-46))

HARPER, Paul V., Diagnostic uses for $Tc\text{-}99^m$, 18: 15913 (TID-7689 (p.1-11))

HARPER, Paul V., Use of I-125 as label in immunologic studies, 18: 15916 (TID-7689(p.17-20))

HARRINGTON, J. M., Occurrence of polar cap absorption, 18: 16824

HARRIS, F. E., Study of the LiH molecule, 18: 16671

HARRISON, M. T., Parathyroid function after I-131 therapy, 18: 15926

HART, Patrick E., Vapor pressure and heat of sublimation of BaF_2, 18: 16006 (UCRL-11124)

HARTING, D., Elastic scattering (π^2-p and p-p), 18: 16789

HARTMAN, Werner, Device for measuring thickness of materials by absorption of β rays, 18: 16396

HARVEY, B. G., Strongly populated levels of $(d_{3/2})^{\frac{1}{2}}$ and $(f_{7/2})^{\frac{1}{2}}$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))

HASHMI, M., Particle losses of Cs plasma in stellarator, 18: 17228

HASSID, A., High-pressure facility for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)

HASSIG, Jean-Marc, Devices for anchoring and extracting plugs in fuel channel, 18: 17272

HASTERLIK, R. J., Leukemia among children in suburban community, 18: 15749

HATCH, Theodore F., Pulmonary deposition and retention of inhaled aerosols, 18: 15806

HAUPTMANN, A., Gammacardiography, 18: 15925

HAUSKNECHT, D. F., Critical U fuel elements in graphite lattice, 18: 16739 (NAA-SR-7541)

HAWTHORNE, J. R., Prog. rpt. on irradiation effects on structural materials 11/62–1/63, 18: 16527 (NRL-Memo-1393)

HAYES, F. N., Oligonucleotide synthesis, 18: 15779 (LAMS-3034(p.329-49))

HAYES, F. N., Representation of oligonucleotides, 18: 15745 (LAMS-3034(p.326-8))

HAYES, R. L., Demonstration of delayed excretion of Fe-59, 18: 15934

HAYESLIP, David, Radiation effect on the kidney, 18: 15880

HAYMAN, Charles R., System to obtain data on population exposure to x rays, 18: 16248

HEACOCK, R. R., Geomagnetic agitation and overhead aurora, 18: 16860

HEALY, T. V., Rapid solvent extraction for fission product separation. I and II., 18: 16147

HEARD, M. J., New film holder for personnel dosimetry, 18: 16258

HEATH, C. W., Jr., Leukemia among children in suburban community, 18: 15749

HEBDEN, Donald, Liquid-liquid contacting apparatus, 18: 16158

HEIN, R. A., Superconductivity in Ge telluride, 18: 16888

HEKMATPANAH, J., Percutaneous cordotomy for pain, 18: 15734 (ACRH-20(p.37-46))

HELHOLTZ, J., Boundary conditions in gap geometry, 18: 17256

HELLEINER, Christopher W., Deoxyribonucleic acid polymerase in L cells. II., 18: 15831

HELLER, Leon, Low-energy neutrino cross sections, 18: 16760 (LAMS-3013)

HELLMAN, O., Electromagnetic field of moving electron, 18: 16797

HELMUT, Paul, Resolution correction for magnetic β spectrometer, 18: 16306 (SGAE-PH-3/1964)

HENCHMAN, Michael, ESR study of NO_2 and NO_3 in irradiated Pb nitrate, 18: 16087

HENDERSON, Joshua E., Modification of anthrax by radiation, 18: 15858

HENDLEY, S. M., TURBO*—two-dimensional depletion code, 18: 17280 (WCAP-6059)

HENKE, G., Detection of radioisotopes in urine. I., 18: 15987

HENKE, G., Detection of radioisotopes in urine. II., 18: 15988

HENKE, G., Detection of radioisotopes in urine. III., 18: 15989

HENRY, R. J. W., Spin change cross sections between H atoms, 18: 16678

HENSLEY, J. C., Inability of mouse to recognize γ radiations. I.,

18: 15811 (LAMS-3034(p.133-40))
HERICKHOFF, R. J., Detection of plasma radiation from electron-bombarded Al and Mg, 18: 16670
HERMANN, Robert, Contractions of Lie groups, 18: 16420
HERMANS, Marie E. A., Preparation of granular, ammonium uranyl sulfate, 18: 16065
HERMEL, Mortimer B., Effect of adrenal irradiation upon aldosterone production in the rat, 18: 15842
HEROUX, L., Electron temperature in high-temperature plasma, 18: 17185
HERRING, Conyers, Asymptotic exchange coupling of two H atoms, 18: 16669
HERRMANN, S., Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
HERSZBERG, B., Radiochemical determination of Sr-90 in rain water, 18: 15958 (SCPRI(S)-81)
HERVEY, Ralph J., Microbial survival in γ-irradiated soils, 18: 15885
HESSINGER, Philip S., Low-density thermal insulation materials, 18: 16520
HEYBOER, R. J., Critical facility KRITO, 18: 17276 (EUR-498.e)
HEYMAN, M., Construction of generator of 14-Mev polarized neutrons, 18: 16902
HEYSSEL, Robert M., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
HIEBERT, Homer Leonard, Radiation dosimeter, 18: 16368
HILL, G. E., Arctic communications following solar disturbances, 18: 16841
HILL, N. A., Monoclinic-cubic transfomation in ThC_2, 18: 16477 (ORNL-3588)
HILL, P. W., The spectra of He stars. I., 18: 16630
HILT, Richard L., Nuclear magnetic relaxation of three-spin systems, 18: 17076
HILTON, John L., Massive conversion of 750-kev ions to neutrals, 18: 16707
HINDS, S., Energy levels of Na-22, 18: 17055
HINE, R. E., Oligonuclootide synthesis, 18: 15779 (LAMS-3034(p.329-49))
HINES, C. O., Geomagnetism and the ionosphere, 18: 16855
HINES, C. O., Geomagnetism and the ionosphere, 18: 16873
HINTZ, E., Influence of impurities on high-density D plasma, 18: 17179
HIRSCHBERG, Joseph G., Doppler temperatures in the C Stellarator, 18: 17170
HIRSHFELD, M. A., Pressure-induced shifts of DCl lines due to HCl, 18: 16025
HISER, R. A., Air sampling of Be production facilities, 18: 16236
HISKES, John R., Cascade processes in energetic neutral H beams, 18: 17194
HOALST, Kay M., Combination radiation detector and amplifier, 18: 16373
HOBBS, Betty C., Radiation for elimination of Salmonellae from foods, 18: 15854
HODARA, H., Plasma diagnostic techniques, 18: 17144
HODGES, H., Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
HODGSON, William G., ESR studies of irradiated polypropylene, 18: 16097
HOECKER, Frank Edward, Radiation dosimeter, 18: 16368
HOEGAASEN, J., Spurious states in the quasi-particle approximation, 18: 17082
HOESSELBARTH, H., Human-body counter, 18: 16244
HOFFMAN, Nathan J., Attack of refractory metals by alkali metals, 18: 16447
HOFFMANN, F., General alarm system, 18: 16605 (CERN-64-7)
HOFMANN, Fritz W., Ion measurement in a Ba plasma, 18: 17168
HOGREBE, K., Change of tritiated water in hydrocarbon, 18: 16073
HOH, F. C., Resistive instability in low-pressure plasma, 18: 17230
HOLLANDER, Martin V., Measurement of diffusivity in high viscosity liquid, 18: 15998 (TID-7688(p.52-63))
HOLLERAN, E. M., Equation of state for *para* hydrogen, 18: 16654
HOLLEY, Charles E., Jr., Solution calorimeter, 18: 16276 (LA-3031)
HOLLINGSWORTH, Donald H., Jr., Cerium monosulfide articles, 18: 16437
HOLLOWAY, J. H., New noble gas compounds, 18: 16050
HONDA, Masatake, Spallation cross sections for long-lived radionuclides, 18: 17049
HONE, A., Influence of electric current on segregation, 18: 17367 (AEC-tr-6376)
HONE, Andre, Effect of electrical current on segregation, 18: 16428 (AEC-tr-6366)
HONSTEAD, J. F., Ground disposal in waste management, 18: 17338
HOOP, B., Jr., Polarization of neutrons from T(p,n)He^3, 18: 17052
HOPKINS, P. A., Nucleic acids: automated base analysis, 18: 15954 (LAMS-3034(p.313-18))
HORANI, M., Inelastic collisions between electrons and some molecules, 18: 16700
HORIE, Kinuko, Gamma rays from reaction $Si^{30}(p,\gamma)P^{31}$, 18: 17059
HORIE, Tadao, Angular momentum conservation for abnormal rotation of OH* split from H_2O, 18: 16024
HORIKAWA, M., Radiosensitivity and SH compounds in mammalian cells, 18: 15897
HORNE, R. A., Proton mobility and electron exchange in aqueous media, 18: 16019
HORNYAK, W. J., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
HOSLER, W. R., Electronic transport in Sr titanate, 18: 16045
HOWARD, R., Z-pinch dynamics, 18: 17160
HOWE, Eugene E., Residue studies with radioisotopic drugs, 18: 15784 (TID-7689(p.58-62))
HSU, H. F., Rhesus monkeys immunized against *Schistosoma japonicum* by administration of x-irradiated cercariae, 18: 15890
HSU, S. Y. Li, Rhesus monkeys immunized against *Schistosoma japonicum* by administration of x-irradiated cercariae, 18: 15890
HUANG, C. L., Effect of uv radiation on chlorpromazine. I., 18: 16092
HUANG, Nien-ning, Partial wave analysis of photopion production process, 18: 16798
HUBBARD, Paul S., Nuclear magnetic relaxation of three-spin systems, 18: 17076
HUBER, D. A., Isothermal turbulent flow through fuel geometries, 18: 17253
HUBER, Elmer J., Jr., Solution calorimeter, 18: 16276 (LA-3031)
HUBERT, P., Proceedings of sixth international conference on ionization phenomena in gases, Paris, 7/63. I., 18: 16689
HUCK, A., Discrimination of particles in organic scintillators, 18: 16324
HUDSON, D., Basic equations for Monte Carlo method, 18: 16410 (CERN-64-13(Vol.I)(p.169-72))
HUDSON, D., Generating random numbers on computer, 18: 16411 (CERN-64-13(Vol.I)(p.173-6))
HUFFMAN, R. E., Helium and Ar emission continua, 18: 16717
HUGHES, Alun, Autoradiography of H-3 on chromatograms, 18: 15984
HUGHES, E. E., Half life of C-14: comments on mass-spectrometric method, 18: 16961
HUGHES, T. C., Determination of Rb and Cs in stony meteorites, 18: 15976
HUISKAMP, W. J., Heat capacities of Tb and Ho, 18: 16516
HULL, D. E., Acid circulation, volume, replacement, and entrainment measured in alkylation plant with radiotracer, 18: 16067 (TID-7689 (p.128-33))
HULL, D. E., Radiotracer analysis of catalyst flow distribution, 18: 16390 (TID-7688(p.84-90))
HULL, McAllister H., Jr., Prog. rpt. on nucleon-nucleon interaction, annual, 2/64, 18: 16953 (TID-20352)
HULM, J. K., Superconductivity in Ge telluride, 18: 16888
HULTQVIST, Bengt, Influence of solar disturbances on vlf radio waves, 18: 16830
HUMASON, G. L., Establishment of karyographic methods as tool in radiopathology, 18: 15738 (LAMS-3034(p.227-34))
HUMBLET, J., Perturbation of resonance levels of nuclei, 18: 16997
HURE, Jacques, Separating Zr and Hf, 18: 16155
HUSACK, Ralph, Effect of γ radiation on anthracite, 18: 16523 (BM-RI-6391)
HUSTON, Frank V., Digital and analog methods for radioisotope measurement, 18: 15917 (TID-7689(p.25-8))
HUSTON, John L., Xenon tetroxide: preparation and properties, 18: 16052
HUTCHINSON, P., Diagram expressions useful in theory of fluids, 18: 16548 (AERE-R-4494)
HUYNH, V.-D., Interaction of resonance neutrons with nuclei. I., 18: 17033
HUYNH, V.-D., Interaction of resonance neutrons with nuclei. II., 18: 17034
HUYNH, V.-D., Interaction of resonance neutrons with nuclei. III., 18: 17035
HUYNH, V.-D., Interaction of resonance neutrons with nuclei. IV.,

18: 17036
HYMAN, J., Jr., Research on ion beam formation from plasma sources, 18: 17240

I

IKEMOTO, Yoshio, Gamma-gamma angular correlations in Sb-125, 18: 17047
IMRE, Kaya, Algebraic structure of cluster expansions in statistical mechanics, 18: 16412 (CNAEM-14)
IMRISOVA, I., Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)
INAMURA, Takashi, Gamma-gamma angular correlations in Sb-125, 18: 17047
INGARD, K. U., Some characteristic features of Cherenkov radiation, 18: 17190
INGRAHAM, J. Charles, Electron energy decay in He afterglow, 18: 17232
INOUE, Makoto, Scattering of α particles by medium-weight nuclei, 18: 17046
INUISHI, Yoshio, Radiation damage and annealing in Si, 18: 16534
IORI, I., Cross sections from $Al^{27}(d,\alpha)Mg^{25}$ reactions, 18: 17072
IORI, I., "Spin cutoff factor" and correlation energy for Si-29, 18: 16995
IRISH, E. R., Prog. rpt. on fixation of radioactive residues, 10–12/63, 18: 17332 (HW-80526)
IRVINE, J. M., Pairing correlations in infinite systems, 18: 17084
ISABELLE, D. B., Excited states of O-16 by inelastic scattering of electrons, 18: 17027
ISAKOVA, L. Ya, Efficiency of system of absorber-type rods, 18: 17259 (NP-13659)
ISHIDA, Morihiro, Studies of mortality of A-bomb survivors. II., 18: 15875
ISRAEL, H. I., Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))
IVANOV, A. N., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
IVANOV, I. K., Geochronology of the quaternary period, 18: 16219
IVANOV, V. I., Problems in dosimetry and radiation protection. II., 18: 17246
IVANOV, Yu. S., Recovery time of Wilson chambers, 18: 16333
IWASHITA, Takeki, Gamma-gamma angular correlations in Sb-125, 18: 17047
IYENGAR, P. K., Neutron spectrometry at Trombay, 18: 16352
IZAWA, Kimie, Potentiometric titration of free acid and U in U(VI) solution, 18: 15966

J

JABLON, Seymour, Studies of mortality of A-bomb survivors. II., 18: 15875
JACKSON, Daphne F., Validity of WKB approximation for high-energy distorted wave calculations, 18: 16906 (ANL-6848(p.2-7))
JACKSON, Julius L., Continuum description of high-temperature plasma, 18: 17204
JACMART, J. C., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
JACMART, J. C., Inelastic scattering of 155-Mev protons on light nuclei, 18: 17070
JACMART, J. C., Scattering of protons on Na-23, Al-27, P-31, K-39, Ti-48, Cr-52, Fe-56, and Co-59, 18: 17071
JACOBS, D. G., Deep-well disposal of radioactive wastes, 18: 17342
JACOBS, Paul F., Radiation probe for arcjet measurements, 18: 17138
JACOBSON, H. I., Synthesis, storage, and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
JACOBSON, Leon O., Prog. rpt. on biological research, 9/63, 18: 15733 (ACRH-20)
JAFFE, J. H., Pressure-induced shifts of DCl lines due to HCl, 18: 16025
JAIN, G. C., Germanium cells for radiant energy conversion, 18: 16746
JAMERSON, F. E., Prog. rpt. on direct conversion of nuclear energy, 11/62–10/63, 18: 16740 (AD-425231)
JAMES, M. F., Calculation for heterogeneous fast reactors, 18: 17275 (AEEW-R-183)
JAMES, P. E., Silage density measured by γ attenuation, 18: 16393 (TID-7688(p.106-13))
JAMES, Rose Saint, Separating Zr and Hf, 18: 16155
JAMISON, H. C., X radiation in dental offices. II., 18: 16247
JAMMET, H., Application of radiation protection norms, 18: 16254
JANOS, W. A., Formulation of the Fokker-Planck equation, 18: 16818
JANOVSKY, Igor, Radiation effects on extractions and extractants, 18: 16143
JANSEN, Cornelius R., Effects of heavy high-energy charged particles. IV., 18: 15829
JANSEN, Cornelius R., Effects of heavy high-energy charged particles. II., 18: 15827
JANSEN, Cornelius R., Labeling of human globulin with I-124, 18: 15933
JANSEN, L., Knight shift in Be, 18: 16515
JASELSKIS, Bruno, Xenic acid: reduction at dropping-Hg electrode, 18: 16053
JASKE, R. T., Quarry blasting on Hanford reservation, 18: 17317 (HW-79614)
JAUNEAU, L., Statistics and application, 18: 16408 (CERN-64-13(Vol.I) (p.1-86))
JAVERT, Carl T., Carcinoma of the endometrium treated by Ra, 18: 15920
JEDLICKA, James R., Axial flow through wall-constricted d-c arc, 18: 17133
JEN, Ching-je, Effects of distortions and noise on Coulomb scattering in emulsion, 18: 16348
JENKINS, J. D., Compilation of standard cores. I., 18: 17279 (KAPL-M-JDJ-1)
JENKINS, O. G., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
JENKINS, T. R., Fine-grained graphites for nuclear applications, 18: 16465 (AERE-R-3943)
JENS, W. H., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
JENSEN, E. V., Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
JEPSON, K. S., Titanium–Nb system, 18: 16508
JERONYMO, J. M. F., Angular distribution and cross section for $Li^6(p,He^3)He^4$, 18: 17029
JERONYMO, J. M. F., Determination of neutron cross sections, 18: 16970
JERONYMO, J. M. F., Excited levels of Na-23 following α reactions on F-19, 18: 17001
JERONYMO, J. M. F., Reactions (d,p) and (d,d) on C-12, 18: 16991
JESSEPH, John E., Effects of heavy high-energy charged particles. I., 18: 15826
JESSEPH, John E., Effects of heavy high-energy charged particles. II., 18: 15827
JESSEPH, John E., Effects of heavy high-energy charged particles. III., 18: 15828
JESSEPH, John E., Effects of heavy high-energy charged particles. IV., 18: 15829
JESSEPH, John E., Labeling of human globulin with I-124, 18: 15933
JHANANANDA, Swami, Radioactive decay of Cd-115m, 18: 17056
JOANOU, G. D., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)
JOFFRE, H., Problems of β, γ, and x-ray personnel dosimetry, 18: 16364
JOHLER, J. R., Effect of solar disturbances on Ionosphere Reflection, 18: 16846
JOHNSON, Adger S., Cerium monosulfide articles, 18: 16437
JOHNSON, C. C., Mercury arc discharge in a magnetic field, 18: 17142
JOHNSON, C. C., Microwave diagnostics of plasmas, 18: 17143
JOHNSON, Charles S., Jr., Effects of electron transfer on high-resolution NMR spectra, 18: 16027
JOHNSON, Curtis C., Waves in circular plasma column, 18: 17130
JOHNSON, K. E., Electrochemistry of Nb in fused halides, 18: 16032
JOHNSON, O. S., Acute radiosensitivity as function of age in mice, 18: 15807 (LAMS-3034(p.112-15))
JOHNSON, S. O. Young's modulus of graphite at elevated temperatures, 18: 16186 (WADD-TR-61-72(Vol.XXIII))
JOHNSTON, I. D. S., Production of highly excited neutral atoms for injection into plasma devices, 18: 17118 (NP-13744)
JOHNSTON, Richard L., Kinetics of steroid effects on Ca-47 dynamics in dogs. I., 18: 15795
JONES, A. D. W., Stripping and pickup reactions on C-12, C-13, and C-14, 18: 16914 (ANL-6848(p.70-8))

JONES, A. S., Microwave diagnostics of plasmas, 18: 17143
JONES, B. E., New film holder for personnel dosimetry, 18: 16258
JONES, D. C., Effect of age on radiation-induced polydipsia in rat, 18: 15815 (USNRDL-TR-712)
JONES, D. W., Magnetic susceptibility of Ti–H and Nb–H systems, 18: 16502
JONES, F. Llewellyn, Secondary ionization processes in He, 18: 16677
JONES, H. E. H., Effects of steroid sex hormones on immunological phenomena, 18: 15752
JONES, L. V., Prog. rpt., 5/63, 18: 16376 (MLM-1157)
JONES, L. W., Can cosmic rays replace accelerators?, 18: 16729 (BNL-7534(p.29-38))
JONES, L. W., Comments on colliding beams, 18: 16753 (BNL-7534 (p.312-17))
JONES, L. W., Large-angle proton-proton elastic scattering, 18: 16788
JONES, L. W., Physics with colliding beams, 18: 16591 (BNL-7534 (p.253-76))
JONES, Malcolm S., Jr., Physics of pulsed MHD generators, 18: 16743 (MHD-646)
JONSSON, A., One-group collision-probability calculations, 18: 17252
JORDAN, W. C., Plasma behavior in the Bumpy Torus, 18: 17171
JORDYL, George Y., Nuclear power and system characteristics, 18: 17305
JOYET, G., Gammacardiography, 18: 15925
JUDD, B. R., Hyperfine structure of PuI, 18: 17083
JUILLARD, A., Double-focusing electrostatic spectrometer for low-energy electrons, 18: 16325
JUILLARD, A., Internal conversion electrons of $Pm^{151} \rightarrow Sm^{151}$, 18: 17017
JULIEN, J., Interaction of resonance neutrons with nuclei. I., 18: 17033
JULIEN, J., Interaction of resonance neutrons with nuclei. II., 18: 17034
JULIEN, J., Interaction of resonance neutrons with nuclei. III., 18: 17035
JULIEN, J., Interaction of resonance neutrons with nuclei. IV., 18: 17036
JUNG, V., Deuteron-γ angular correlation in $Mg^{24}(d,d'\gamma)$, 18: 16922 (ANL-6848(p.123-4))

K

KADANER, E. S., Softening of Mg alloys, 18: 16496
KADYK, John A., Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
KAEAEMBRE, H., Exoelectron emission of KCl phosphors, 18: 16083
KAGEYAMA, Soizoburo, Gamma-gamma angular correlations in Sb-125, 18: 17047
KAHANE, Jean, Construction of time-of-flight spectrometer, using D(d,n)He^3, 18: 16323
KAHL, G. D., Interferometric analysis of axisymmetric plasma flow, 18: 17175
KAHN, Herbert L., Atomic absorption spectrophotometer, 18: 16281
KALISKI, S., Mechanical generation of Cherenkov radiation, 18: 16765
KALISKI, S., Mechanical generation of Cherenkov radiation, 18: 16766
KALISKI, S., Mechanical generation of Cherenkov radiation, 18: 16767
KALISKI, S., Mechanical generation of Cherenkov radiation, 18: 16768
KALMAN, G., Microstructure of magnetic field in plasma, 18: 17104 (ARL-250(Pt.II))
KALMYKOVA, Z. I., Peculiarities in course and outcome of radiation sickness in dogs injected intravenously with nitrate of Pu-239, 18: 15817 (FTD-TT-63-559(p.150-72))
KAMAEVA, L. A., Control apparatus and shielding of fast pulsed reactor, 18: 17325 (NP-13710)
KAMAZIR, Dusan, Radioresistance of *E. coli*, 18: 15898
KANEEV, M. A., Effects of x and γ radiation on structural changes in CdS, 18: 16125
KANEY, A. R., Radiomimetic action of polyimine chemisterilants in *Neurospora*, 18: 15868
KAPLAN, B. L., Generation of transverse waves by directed explosions, 18: 17372 (UCRL-Trans-992(L))
KAPLAN, M. H., Optimization of ion engine control systems, 18: 16582
KAPPAS, A., Effects of steroid sex hormones on immunological phenomena, 18: 15752
KAPPAS, A., Fever-producing action of steroids, 18: 15755
KAPPAS, A., Metastatic carcinoma or hyperparathyroidism, 18: 15750
KARADENIZ, C., Neutron spectrum produced by Li-7 on Li-6, 18: 17009
KARAL, Frank C., Jr., Waves in a random medium, 18: 16807
KARASIK, V. R., Superconducting magnet with inductive excitation, 18: 16880
KARDASHEV, D. A., Constants in nuclear physics. Handbook, 18: 17255
KARNEY, David H., Subcellular effects of x irradiation, 18: 15864
KARPUKHIN, O. A., Apparatus for measuring angular distribution of annihilation radiation of positrons, 18: 16304 (NP-13693)
KARPUKHIN, V. I., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
KARRAS, H., Coloration layer in deuteron-irradiated LiF crystals, 18: 16108
KASHIWAGI, Michio, ESR of irradiated ϵ-caprolactam, 18: 16090
KASS, S., Corrosion and H absorption of Zy-2, 18: 16440 (WAPD-283)
KASSATKIN, M., Reactivating yeast organisms after radiation injury, 18: 15819 (UCRL-Trans-1029)
KASSNER, Ewald, Synthetic incorporation of C-14 into tropine, (±) tropic acid, and atropine, 18: 16069
KASUGA, Takashi, Angular momentum conservation for abnormal rotation of OH* split from H_2O, 18: 16024
KATAKIS, D., Radiolytic oxidation of ferrous ion, 18: 16095
KATASE, A., Fission of Th-232 induced by He ions, 18: 17067
KATHREN, R. L., Health physics following nuclear excursion, 18: 16242
KATYKHIN, G. C., β_0 component in Pb-210 decay, 18: 17094
KATZ, J. J., Effect of D_2O on growth of peppermint. I., 18: 15861
KAUFMAN, J. V. Richard, "Spherical hot spots" from π capture in explosives, 18: 16026
KAUFMAN, S. F., Fabrication of B_4C and B_4C + SiC mixtures, 18: 16427 (WAPD-244)
KAUL, W., Lifetime of excited states in $X^* + Y \rightarrow XY^* + e$, 18: 16721
KAURANEN, Pentti, Survey of photoneutron sources, 18: 16379
KAWASHIMA, Nobuki, Interaction of plasma stream with dipole, 18: 17149
KAWIN, Bergene, Digital and analog methods for radioisotope measurement, 18: 15917 (TID-7689(p.25-8))
KAY, M. A., Effect of radionuclide fractionation on exposure dose rate from local fallout, 18: 16234 (USNRDL-TR-715)
KAYE, S. V., Weights of cotton rats, 18: 15760
KELLER, G. E., Mobilities of mass-indentified ions in N, 18: 16057
KELLER, Joseph B., Waves in a random medium, 18: 16807
KELLETT, E. A., Structural features of C and graphite, 18: 16491
KELLY, H. P., Weakly coupled vibrations of a $f_{7/2}$-particle, 18: 17075
KELLY, Hugh P., Second-order perturbation theory in quantum mechanics, 18: 16801
KELSEY, C. A., Polarization of neutrons from T(p,n)He^3, 18: 17052
KEMENY, L. G., Operation of BR-2 reactor, 3/31–4/21/63, 18: 17303 (NP-tr-1121)
KEMENY, L. G., Operation of BR-2 reactor, 4/21–5/12/63, 18: 17304 (NP-tr-1122)
KEMP, R. F., Ion beam neutral component determinations, 18: 16581
KEMPE, Lloyd L., Sterilization of barley malt with γ radiation, 18: 15841
KENDALL, P. C., Solar eclipse and solar flare effects in the F2 region, 18: 16643
KENEALLY, E., Birefringence in irradiated polyethylene, 18: 16098
KEREIAKES, James G., Radiation exposure from radioiodine, 18: 15939
KERMAN, Arthur K., Finite-range n-p potential in Coulomb stripping reactions, 18: 16911 (ANL-6848(p.43-50))
KERMAN, R. K., Pion nuclear elastic charge-exchange scattering, 18: 16939 (ANL-6848(p.236-9))
KERR, V. N., Oligonucleotide synthesis, 18: 15779 (LAMS-3034(p.329-49))
KERVALIDZE, K. N., Plasma properties in theta pinch, 18: 17159
KESSEY, K. O., MHD species separation in gaseous nuclear rocket, 18: 17323
KEYS, W. Scott, Migration of isotopes at NRTS, 18: 17349
KHACHATURYAN, M. N., Cherenkov spectrometer for measuring γ energy, 18: 16330
KHAIDAROV, Kh., Absorption of γ rays by burnt bricks, 18: 17245
KHAN, J. M., Characteristic x-ray production in the L shell of Cu, 18: 16663
KHARCHENKO, I. F., Excitation of oscillations by electron beam in plasma, 18: 17112 (NP-13697)
KHAUZER, I., Energy dependence of proton range in emulsion, 18: 16344
KHIZHNYAK, N. A., Motion of plasma bunch in magnetic field of toroidal solenoid, 18: 17113 (NP-13698)
KHIZNICHENKO, L. P., Effects of γ radiation on mechanical properties of

Se, 18: 16542
KIHARA, Taro, Unified theory of relaxations in plasma, 18: 17106 (IPPJ-17)
KIKHNO, V. S., Fusibility diagram for NaF–KF–ZrF_4 system, 18: 16008 (ORNL-tr-31)
KIKUCHI, R., Calculating density matrix based on path integrals, 18: 16652 (UCRL-Trans-1026(L))
KIM, H. K., Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)
KIMELDORF, D. J., Effect of age on radiation-induced polydipsia in rat, 18: 15815 (USNRDL-TR-712)
KIMELDORF, D. J., Response of insect eye to β radiation, 18: 15814 (USNRDL-TR-698)
KIND, N. V., Geochronology of the quaternary period, 18: 16219
KING, J. W., Relationships between magnetic and ionospheric variations, 18: 16856
KINGSTON, A. E., Collisional-radiative recombination, 18: 17184
KINNAMON, Kenneth E., Placental transfer of Zn-65 in the rat, 18: 15794
KINO, G. S., Cesium plasma measurements, 18: 17127
KINSLOW, Max, Gasdynamic diagnosis of flows from plasma states, 18: 17136
KIRILLOV, P. L., Heat exchange in liquid metals in pipes, 18: 16174 (NP-13660)
KIRKBRIDE, J., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)
KIRSANOV, V. S., Measurement of vacuum by means of radioactive preparations, 18: 16395
KISTEMAKER, J., Electron capture into an excited state by H^+ and He^+, 18: 16705
KISTEMAKER, J., Heat of sublimation and vapor pressure of Sr, 18: 16517
KISTEMAKER, J., Sputtering of Cu by 20-kev noble gas ions, 18: 16673
KITAGAWA, Toyokichi, Nuclear hyperfine coupling constants in EPR spectra, 18: 16068
KLAPISCH, R., Production of Li-6 and Li-7 fragments in elements, 18: 16977
KLEIN, A. H., Thermal study of the W bronzes. I., 18: 16030
KLEIN, Lewis S., Continuum description of high-temperature plasma, 18: 17204
KLEINSTUECK, K., Neutron diffraction of ideal crystals, 18: 16510
KLEMPERER, William, Dipole moments of excited electronic states of molecules, 18: 17352 (CONF-417-6)
KLEVANS, Edward H., Theory of plasma oscillations with pair correlations, 18: 17201
KLING, Robert P., Suppression of pituitary function in diabetic retinopathy, 18: 15927
KNAUER, Friedrich, Limits of detectability of weak alkali molecular beams through ionization on hot W, 18: 16555 (UCRL-Trans-1031)
KNAUER, Friedrich, Velocity distribution in molecular beam by measurement of time of flight, 18: 16653 (UCRL-Trans-1032)
KNECHTLI, R. C., Research on ion beam formation from plasma sources, 18: 17240
KNIGHT, B., Gamma radiolysis of H_2O vapor, 18: 16105
KNOLL, Peter, Technology of isotope production. I., 18: 16401 (ZFK-RCH-1)
KNOP, C. M., Plasma diagnostic techniques, 18: 17144
KNOTT, David H., Radiation effects on response of dog to hemorrhagic stress, 18: 15886
KNOTT, R. G. A., Analysis of afterglow plasma in Ar, 18: 17234
KOBYSHEV, G. I., Hydrogen bonding with $UO_2(NO_3)_2 \cdot 6H_2O$, 18: 16043
KOCH, L., Apparatus for fast liquid-liquid extraction, 18: 16146
KOCH, R. C., Radiochemistry during startup and operation of *Savannah*, 18: 17320 (NSEC-72)
KOCH, W., Determination of Ξ decay parameters, 18: 16756 (CERN-64-13(Vol.II)(p.75-111))
KOCH, W., Methods of spin determination of elementary particles and resonances, 18: 16757 (CERN-64-13(Vol.II)(p.113-92))
KOEPKE, John A., Method for Fe-55 and Fe-59 assay in mixed plasma preparations, 18: 15980
KOHL, H., Semidiurnal and diurnal drifts in the F region, 18: 16867
KOLB, Alan C., Power loss from θ pinches by impurity radiation, 18: 17167
KOMAR, E. T., Characteristics of "Tokomak-III," 18: 17111 (NP-13696)
KOMAROV, V. A., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092
KOMAROV, V. A., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
KONDRAT'EVA, M. A., Cosmic radiation beyond atmosphere, 18: 16732 (FTD-TT-64-90(p.163-76))
KONOBEEVSKII, S. T., Plutonium alloys, 18: 16493
KONONOV, B. A., Electron component of betatron radiation, 18: 16625
KONTIS, Steven S., Effect of irradiation on recoil phenomena in crystals, 18: 16113
KOPPE, Heinz, Partition function of fully ionized gas, 18: 17207
KOPPEL, J. U., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)
KOPYTIN, N. S., Elastic scattering of 0.65-Mev neutrons, 18: 17089
KORDYUK, R. A., System CaO–MgO–Al_2O_3–ZrO_2, 18: 16490
KORKISCH, Johann, Separation of U, Th, and rare earths by anion exchange, 18: 16131
KORNIENKO, L. S., Spectrometer for investigating spin-lattice relaxation spectra, 18: 16342
KORNILOV, E. A., Excitation of oscillations by electron beam in plasma, 18: 17112 (NP-13697)
KORZH, I. A., Angular distributions of 0.3-Mev neutrons elastically scattered, 18: 17090
KORZH, I. A., Elastic scattering of 0.65-Mev neutrons, 18: 17089
KOSSANYI, P., Scattering of high-energy electrons by P-31, 18: 17025
KOSTOWSKI, Edward, Uncontrolled power rise in heterogeneous nuclear reactor after change in reactivity, 18: 17285
KOTITZ, G., Coloration layer in deuteron-irradiated LiF crystals, 18: 16108
KOURIM, Vaclav, Separation of Zr^{95}–Nb^{95} from fission product solution, 18: 16144
KOVAC, L. R., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
KOVALENKO, V. A., Optimum parameters of GVL-2 magnetic system, 18: 17116 (NP-13711)
KOVALEVSKII, K. L., Autoinfection (intestinal) in radiation sickness, 18: 15903
KOVANITZ, P., Servosystems for control of nuclear reactors, 18: 17263
KOVAR, F. R., Drift velocity of ions in Hg vapor, 18: 16061
KOWALSKI, L., Fission of U, Bi, and Au, induced by 156-Mev protons, 18: 17004
KRACIK, J., Stationary thread glow discharge, 18: 16558
KRASNOV, L. V., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
KRASZNAI, Istvan, Dosimetry of the isotope I-131, 18: 15941
KRAVCHENKO, L. Kh., Separation of lanthanides in NH_4NO_3 by zone crystallization. III., 18: 16137
KREJCI, V., Theory of moving striations in a d-c discharge plasma. II., 18: 17124
KRIKORIAN, N. H., Concentration region of homogeneity of carbides of transition metals, 18: 16483 (AEC-tr-6374)
KRIVANEK, M., Probes for adjusting the cyclotron beam, 18: 16618
KRIVULYA, S. S., High-frequency field strength measurements in plasma by Stark effect, 18: 17188
KROELL, W., Lowering of ionization energy for plasma, 18: 17208
KROELL, W., Thermal instability of plasma column, 18: 17229
KROGH, Erik, Radiation necrosis of the cerebellum, 18: 15830
KROKOWSKI, E., Eye protection during irradiation therapy and diagnosis, 18: 15944
KROPSCHOT, R. H., Superconducting In–Pb alloys, 18: 16884
KRTIL, Josef, Separation of Zr^{95}–Nb^{95} from fission product solution, 18: 16144
KRUGER, M., Dependence of sheet metal surface roughness on pretreatment, 18: 16457 (AI-Trans-41)
KRUGER, P. G., Superconducting materials and possible applications, 18: 16602 (BNL-7534(p.417-47))
KRUMBEIN, A. D., Using γ transmission to determine shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))
KUAN, Hsia-min, Excitation function of the $N^{14}(p,n)O^{14}$ total cross section, 18: 17061
KUAN, Hsia-min, Investigation of C-12 + He-3 reactions between 1.8 and 5.4 Mev, 18: 17060

KUBO, Hiroshi, Microwave radiation from plasma. I., 18: 17147
KUBO, Hiroshi, Microwave radiation from plasma. II., 18: 17148
KUBO, Ryogo, Analytical method in statistical mechanics, 18: 16487 (UCRL-Trans-1030(L))
KUCKES, A. F., Effect of collisions upon plasma ion oscillations, 18: 17166
KUDASHEVA, N. P., Peculiarities in course and outcome of radiation sickness in dogs injected intravenously with nitrate of Pu-239, 18: 15817 (FTD-TT-63-559(p.150-72))
KUHLMAN, Carl W., Luminescence of rare-earth chelates, 18: 16089
KULSRUD, Russell M., Breakdown of He in stellarator by magnetic pumping, 18: 17156
KUMABE, Isao, Scattering of α particles by medium-weight nuclei, 18: 17046
KUMAGAI, Lindy F., Synthesis of ring-labeled L-thyroxine-C^{14}, 18: 16074
KUMMEROW, Fred A., Chemical synthesis of H^3-labeled linoleic acid, 18: 16070
KUNKEL, Wulf B., Heating of electrons in crossed fields, 18: 17214
KUNKLER, P. B., Radiation damage to thoracic tissues, 18: 15888
KURITA, Yukio, ESR of irradiated ϵ-caprolactam, 18: 16090
KURODA, K., Parameters P and D in p-p scattering at 138 Mev, 18: 16772
KUROHARA, Samuel S., Effect of thyroparathyroidectomy on radiation-induced creatinuria in rats, 18: 15876
KUSHTA, G. P., Roentgen interferences of W over range of 300 to 1100°K, 18: 16687
KUTAITSEV, V. I., Plutonium alloys, 18: 16493
KUTSYNA, L. M., Liquid scintillator, 18: 16375
KUYATT, C. E., Ionization limit in inelastic electron scattering in the rare gases, 18: 16697
KUZINA, A. F., Inhibiting properties of pertechnetate ion, 18: 16443 (ORNL-tr-32)
KUZNETSOV, V. F., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
KUZNETSOV, V. N., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
KVARTSKHAVA, I. F., Plasma properties in theta pinch, 18: 17159

L

LA BAUVE, P. M., Chromosome observations in nonirradiated progeny from irradiated RF males, 18: 15812 (LAMS-3034(p.303-6))
LA BAUVE, P. M., Chromosomes in transplanted leukemia of mice, 18: 15744 (LAMS-3034(p.307-11))
LABEYRIE, Jacques, Determination of Mn-54 in Fe meteorite, 18: 15985
LACEFIELD, W. B., Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)
LACINA, J., Hamiltonian of guiding center im EM field, 18: 17125
LADU, M., Measurement of fast neutron flux by means of a non-directional counter, 18: 16362
LAFONTAINE, A., Significance of results obtained by personnel dosimetry, 18: 16264
LAGERQVIST, A., Spectra of PdH and PdD, 18: 16575
LAJTHA, L. G., Method for investigation of stem-cell kinetics, 18: 15833
LAKSHMINARAYANA, V., Radioactive decay of Cd-115m, 18: 17056
LAL, D., Synthesis of methane from water for tritium measurement, 18: 16075
LAL, Devendra, Spallation cross sections for long-lived radionuclides, 18: 17049
LAMBERT, W. H., Handling and transportation tests of PM-1, 18: 17299 (MND-M-1915)
LA MONT, B. D., Bibliography of analytical methods for alkali metals, 18: 15964 (WCAP-2540)
LANDAU, R. L., Metastatic carcinoma or hyperparathyroidism, 18: 15750
LANDE, A., Multiparticle excitations in intermediate compound state, 18: 17079
LANDMARK, B., H-f communications during polar radio blackouts, 18: 16828
LANDMARK, B., Influence of polar radio blackouts on vlf circuits, 18: 16829
LANDSPERSKY', H., Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)
LANGE, Robert C., Polonium, 18: 15946 (MLM-1165(Tr))
LANGEVIN, M., Giant resonance in heavy nuclei by scattering of bremsstrahlung, 18: 17040
LANGEVIN, M., Mössbauer effect in $FeCl_3 \cdot 6H_2O$, 18: 16036
LANGHEINRICH, D., Etch-pit observations concerning twins in Fe and Fe alloys, 18: 16471 (EURAEC-978)
LANGMEAD, W. A., External radiation dosimetry practice at UKAEA, 18: 16266
LANZ, R., Catalytic reduction of U(VI) by formic acid, 18: 15997 (RT/CHI(63)-32)
LARENZ, R. W., Divergence problem of the partition function, 18: 17206
LARKINS, J. H., Thermoluminescent dosimetry with activated LiF, 18: 16303 (LAMS-3034(p.205-23))
LARRABEE, G. B., Application of radiochemistry to semiconductor research, 18: 16385 (TID-7688(p.38-40))
LARRABEE, J. C., Helium and Ar emission continua, 18: 16717
LARSEN, Arvid, Relative frequencies of ion clusters, 18: 16109
LARSON, C. L., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
LARY, E. C., Comment on modified Penning arc plasma ejector, 18: 17123
LASCHI, R., Radiation effects on pleural exudation, 18: 15877
LASLETT, L. J., Intensity limitations imposed by transverse space-charge effects in circular particle accelerators, 18: 16593 (BNL-7534(p.324-67))
LATHROP, K. A., Nuclear needle for neurosurgery, 18: 15912 (ACRH-20(p.25-36))
LATHROP, Katherine A., Diagnostic uses for $Tc\text{-}99^m$, 18: 15913 (TID-7689(p.1-11))
LAUER, E. J., Plasma behavior in the Bumpy Torus, 18: 17171
LAUER, K. F., Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
LAUMETS, E., Soil-moisture prediction method for induced-activity prediction system, 18: 16206 (USNRDL-TR-662)
LAURAT, M., Inelastic scattering of 800-kev neutrons by I-127, 18: 17039
LAVIE, J. M., External radiation dosimetry practices in the CEA, 18: 16267
LAVRUKHINA, A. K., Radiochemical analysis, 18: 15992
LAWRENCE, C. A., Immunogenicity of irradiated *Mycobacterium tuberculosis*, 18: 15824
LAWRENCE, John H., Suppression of pituitary function in diabetic retinopathy, 18: 15927
LAYLOFF, Thomas, Nuclear hyperfine coupling constants in EPR spectra, 18: 16068
LAZAR, A. W., Metastatic carcinoma or hyperparathyroidism, 18: 15750
LEACH, S., Inelastic collisions between electrons and some molecules, 18: 16700
LEANG, C. F., Alpha spectrography of Ra-226 and levels of even-A Rn isotopes, 18: 16984
LEBLANC, M. A. R., Critical current in type II superconductor, 18: 16883
LEBON, G., Perturbation of resonance levels of nuclei, 18: 16997
LEDERER, M., Chromatography on ion exchange papers. IX., 18: 16139
LEDERER, M., Chromatography on ion exchange papers. X., 18: 16140
LEDERMAN, L. M., Alternative activity to storage rings—high-intensity AGS, 18: 16596 (BNL-7534(p.379-84))
LEE, A. R., Positive ion stripping studies at 100–450 kev, 18: 16712
LEE, C. H., Nuclear potential in axiomatic quantum field theory, 18: 17050
LEE, Edward K. C., Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
LEE, James K., Tracer studies of impurity-doped oxide cathodes, 18: 16003 (TID-7689(p.136-7))
LEE, L. L., Jr., Reactions (d,n) on Fe-54 and Ni-58, 18: 16917 (ANL-6848(p.98-103))
LEE, T. H., Motion of ions in cathode sheath of an arc, 18: 17239
LEE, Y. Y., Determination of spin f^9 resonance, 18: 16792
LEFFERT, C. B., Prog. rpt. on direct conversion of nuclear energy, 11/62–10/63, 18: 16740 (AD-425231)
LEFORT, M., De-excitation of Dy obtained by proton bombardment of Tb, 18: 16975
LEGG, J. C., Analysis of $Cr^{52}(d,p)Cr^{53}$ reaction, 18: 16913 (ANL-6848 (p.63-9))
LEGGETT, Robert D., Nuclear reactor fuel members, 18: 16449
LEGLER, B. M., Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
LE GRIVES, Emile, Basic measurements in a rail-type plasma gun, 18: 17131

LEHMANN, J., Behavior of β-γ directional correlation in disintegration of Ho-166, 18: 17011
LEHRER-ILAMED, Yehiel, Representations of three-dimensional pure rotation group, 18: 16421
LEIMDOERFER, M., Backscattering of fast neutrons from plane and spherical reflectors, 18: 16896 (NP-13720)
LEIPOLD, M. H., Thermal expansion of yttria-stabilized zirconia, 18: 16500
LEIPZIGER, Fredric D., Geologic age determination by direct Pb isotope analysis, 18: 16218
LEMEILLE, C., Neutron spectrum produced by Li-7 on Li-6, 18: 17009
LEMEILLE, C., Nuclear reactions produced by Li-6 ions at 5 Mev, 18: 17007
LEMMON, A. W., Jr., Corresponding states behavior of Na, K, Rb, and Cs, 18: 16035
LEMOINE, J., Underground storage for radioactive wastes, 18: 17340
LENCHENKO, V. M., Application of $B^{10}(n,\alpha)Li^7$ reaction to determination of B in Si, 18: 15993
LENCHENKO, V. M., Energy losses by complex particles in rarefied and condensed media, 18: 16688
LENCHENKO, V. M., Fast particle energy losses on excitation of atomic oscillations, 18: 16544
LENCHENKO, V. M., Radiation-induced diffusion activation in solids, 18: 16543
LEONARD, R. A., Comparison of Mg^{2+}, Ca^{2+}, and Sr^{2+} as exchange ions for mineralogical studies of clays, 18: 16200
LEONTOVICH, M. A., Problems in plasma theory, 18: 17189
LEPECHINSKY, D., Effect of type IV eruptions on absorption, 18: 16834
LEPSCKY, C., Catalytic reduction of U(VI) by formic acid, 18: 15997 (RT/CHI(63)-32)
LEROY, George V., American community looks at civil defense, 18: 16245
LE ROY, George V., Maximum permissible levels for internal contamination, 18: 15910
LEROY, J. L., Total cross sections of Na, Th, and U for neutrons, 18: 16973
LEUCHARS, Elizabeth, Time of action of thymus in irradiated adult mouse, 18: 15869
LEUSHKINA, G. V., Effects of nuclear emission on SiC luminescence, 18: 16122
LEVI, C., Cross sections from $Al^{27}(d,\alpha)Mg^{25}$ reactions, 18: 17072
LEVI, C., Partial excitation functions for $V^{51}(p,n)Cr^{51}$ reactions, 18: 16996
LEVINE, Paul H., Corrections to plasma kinetic theory, 18: 17195
LEVINSKII, Yu. V., Interaction in systems refractory metal–C–N, 18: 16498
LEVKOVSKII, P. T., Converter-switch apparatus for pulse extraction from Geiger counters, 18: 16345
LEVY, R. H., Aerodynamic aspects of magnetospheric flow, 18: 16629 (AD-430410)
LEY, F. J., Radiation for elimination of Salmonellae from foods, 18: 15854
LEYCURAS, Yvonne, Luminescent discharges under pressure and coefficient of recombination, 18: 17236
LEYENDECKER, W., Determination of Al in SAP, 18: 15949 (EUR-585.i)
LI, C. H., Notch impact behavior of W, 18: 16475 (NP-13755)
LI, Che-Yu, Prog. rpt. on solid-liquid interface, 6/6/63–6/5/64, 18: 16005 (TID-20354)
LIBOFF, Richard L., Propagation of plasma waves in magnetic field, 18: 17150
LICHTMAN, S. W., Effects of nuclear detonations in the atmosphere, 18: 16859
LIEB, Elliott H., Ground-state energy of imperfect Bose gas. III., 18: 16811
LIFSHITS, E. V., High-frequency field strength measurements in plasma by Stark effect, 18: 17188
LINCK, J., Study of low levels of Li-6 by $Li^6(He^4,\alpha)Li^6$, 18: 17031
LINCOLN, J. V., Relation of solar active regions to ionospheric disturbances, 18: 16842
LINDSAY, R. K., Osteoradionecrosis of the mandible, 18: 15921
LINFOOT, John A., Suppression of pituitary function in diabetic retinopathy, 18: 15927
LINIGER, Werner, Ground-state energy of imperfect Bose gas. III., 18: 16811
LIPAS, P. O., Nonexistence of collective M1 transitions, 18: 17073
LIPNIK, Beta circularly polarized γ angular correlations in Ag-111, 18: 17018
LIPPINCOTT, Stuart W., Effects of heavy high-energy charged particles. I., 18: 15826
LIPPINCOTT, Stuart W., Effects of heavy high-energy charged particles. II., 18: 15827
LIPPINCOTT, Stuart W., Effects of heavy high-energy charged particles. III., 18: 15828
LIPPINCOTT, Stuart W., Effects of heavy high-energy charged particles. IV., 18: 15829
LIPPINCOTT, Stuart W., Labeling of human globulin with I-124, 18: 15933
LITBIN, V. F., Calibrated multi-angle magnetic analyzer-multispectrograph, 18: 16331
LITTLE, Margaret, Limits of detectability of weak alkali molecular beams through ionization on hot W, 18: 16555 (UCRL-Trans-1031)
LITTLE, Margaret, Velocity distribution in molecular beam by measurement of time of flight, 18: 16653 (UCRL-Trans-1032)
LITVIN, V. F., Differential cross section for proton groups from $Al^{27}(d,p)Al^{28}$, 18: 17091
LITVIN, V. F., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092
LITVIN, V. F., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
LITZ, Lawrence M., Cerium monosulfide articles, 18: 16437
LIU, Ching Shi, One-dimensional magnetogasdynamic flow, 18: 17172
LIU, M., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
LIU, M., Scattering of protons on Na-23, Al-27, P-31, K-39, Ti-48, Cr-52, Fe-56, and Co-59, 18: 17071
LIVETT, R. K., Prog. rpt. on high acceleration field heat transfer for SNAP, 9–11/63, 18: 16177 (TID-20133)
LIVETT, R. K., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
LLORET, A., Pion-nucleon cross section, 18: 16776
LOBANOV, E. M., Application of $B^{10}(n,\alpha)Li^7$ reaction to determination of B in Si, 18: 15993
LOBANOV, E. M., Conductivity of $TlAsSe_2$, $TlAsSe_4$, $As_2Se_3Te_3$, and As_2Se_2Te as function of γ dose, 18: 16541
LOBANOV, E. M., Effects of nuclear emission on SiC luminescence, 18: 16122
LOEB, Harold G., Effect of adrenal irradiation upon aldosterone production in the rat, 18: 15842
LOGAN, R. K., Pion nuclear elastic charge-exchange scattering, 18: 16939 (ANL-6848(p.236-9))
LOGERQUIST, Benjamin A. A., Wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))
LOHMANN, W., Influence of sugars on radiation sensitivity of catalase, 18: 15900
LOISEAUX, J. M., Giant resonance in heavy nuclei by scattering of bremsstrahlung, 18: 17040
LOMBARD, R., Scattering of high-energy electrons by P-31, 18: 17025
LOMBARDI, C., Heat transfer to steam–H_2O mixtures, 18: 16171 (EURAEC-929)
LOMENICK, T. F., Movement of Ru in White Oak Lake bed, 18: 17348
LOMSADZE, Yu., Problems in modern theory of elementary particles. II., 18: 16795
LONCHAMP, Jean-Pierre, Compound nuclei and tangential collisions in reactions of Ne-20 with Ag and Br, 18: 17010
LONDON, J. E., Cellular elements in peripheral blood of monkeys, 18: 15773 (LAMS-3034(p.96-102))
LONDON, J. E., Potassium-40 and Cs-137 levels in beagles, 18: 15771 (LAMS-3034(p.73-5))
LONDON, J. E., Retention of intravenously administered Cs-132, 18: 15764 (LAMS-3034(p.21-33))
LONDON, J. E., Retention of intravenously administered Be-7 by rats, 18: 15769 (LAMS-3034(p.59-64))
LONDON, J. E., Volume and turnover of body water in monkeys, 18: 15772 (LAMS-3034(p.76-80))
LONG, Everett, Heat insulation devices, 18: 17273
LONG, Russell K., Effect of neutron irradiation upon Ge films, 18: 16532
LONGENECKER, John B., Nutritional quality of survival biscuits and crackers, 18: 16237

LONGSTAFF, B., Fine-grained graphites for nuclear applications, 18: 16465 (AERE-R-3943)
LORENZ, A., Milne problem for semi-infinite medium, 18: 16900
LORIMER, A. Ross, Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
LOTT, M., Pulsation by modulation of beam of 150-kev deuterons, 18: 16614
LOTTS, A. L., Thorium–uranium-233 oxide facility, 18: 16455 (ORNL-3539)
LOUTIT, J. F., Ratios of Sr-90 to Ca in milk and in bones of infants, 18: 15796
LOVASI, Jozsef, Thermal decomposition of uranyl nitrate hydrate, 18: 16038
LOVELACE, William E., Discriminations by irradiated and nonirradiated monkeys, 18: 15849
LOVELACE, William E., Rhesus monkeys and whole-body radiation with x rays, 18: 15850
LOVELL, A. C. B., Observation of a solar-type radio burst from flare star, 18: 16638
LOW, W., Microwave attenuation by shocked-heated air, 18: 16565
LOWELL, J., Time effects in superconductivity, 18: 16881
LOWRY, J. Kinsley, Specialized toroidal pressure vessel, 18: 16164 (ERR-AN-174)
LUBITZ, C. R., Reactivity coefficient of Al in PMA, 18: 16738 (KAPL-M-6121)
LUCAS, A. C., Energy- and rate-dependence studies, 18: 16305 (NP-13748)
LUCE, John S., Massive conversion of 750-kev ions to neutrals, 18: 16707
LUDFORD, G. S. S., Hydromagnetics of spherical conductor, 18: 16547 (AD-416626)
LUDFORD, G. S. S., Singular properties of flow patterns at small R_m, 18: 16579
LUETZEN, J., Radioactive waste disposal into North Sea, 18: 17334 (NP-13756(Vol.I))
LUETZEN, J., Radioactive waste disposal into North Sea, 18: 17335 (NP-13756(Vol.II))
LUIDINGA, F., Critical facility KRITO, 18: 17276 (EUR-498.e)
LUIZOVA, L. A., Concentration of charged particles in a discharge, 18: 16659
LUKENS, H. R., Jr., Prog. rpt. on determination of O in K, 12/63, 18: 15951 (GA-4855)
LUKIN, Yu. T., Argon-filled spark chambers, 18: 16337
LUKIN, Yu. T., Investigation of ion drift in Wilson chamber by spark chamber, 18: 16335
LUK'YANOV, A. A., Theory of resonance absorption of neutrons in media, 18: 16895 (NP-13662)
LUMI, Rita, Radioresistance of *E. coli*, 18: 15898
LUSANOVA, L. M., Chemical composition of eye lens at the time of radiation cataracts, 18: 15816 (CEA-tr-R-1635)
LUSHBAUGH, C. C., Electronic measurement of cellular volumes. IV., 18: 15739 (LAMS-3034(p.235-52))
LUSHBAUGH, C. C., Electronic measurement of cellular volumes. V., 18: 15740 (LAMS-3034(p.253-60))
LUSHBAUGH, C. C., Electronic measurement of cellular volumes. VI., 18: 15741 (LAMS-3034(p.261-9))
LUSHBAUGH, C. C., Electronic measurement of cellular volumes. VII., 18: 15742 (LAMS-3034(p.270-8))
LUSHBAUGH, C. C., Electronic measurement of cellular volumes. VIII., 18: 15743 (LAMS-3034(p.279-85))
LUSHBAUGH, C. C., Rapid screening method for detecting abnormal plasma vitamin B_{12}, 18: 15914 (TID-7689(p.11-14))
LUSHBAUGH, C. C., Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
LUTZ, Michael A., Radiant energy loss from Cs–Ar plasma, 18: 17105 (BSD-TDR-64-6)
L'VOV, A. N., Energy levels of nuclei of Cl-35 and K-41, 18: 16945 (NP-13601)
LYALIN, G. N., Hydrogen bonding with $UO_2(NO_3)_2 \cdot 6H_2O$, 18: 16043
LYON, A. J., Geomagnetic anomaly, 18: 16854
LYON, Harvey W., Intraoral findings in humans after exposure to fallout. I., 18: 15843
LYON, W. S., Liquid scintillators using 1-methylnaphthalene, 18: 16317
LYONS, B. J., Radiation chemistry of polyethylene. VI., 18: 16093

M

MACANDER, R. F., Extraction of lanthanons from electrolytes with Li amalgam, 18: 15945 (LADC-6084)
MAC DONALD, F. R., Prog. rpt. on high acceleration field heat transfer for SNAP, 9–11/63, 18: 16177 (TID-20133)
MAC DONALD, F. R., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
MAC DOUGALL, J. A., Osteoradionecrosis of the mandible, 18: 15921
MACDOUGALL, J. D., Physics of graphite-moderated thermal reactors, 18: 17266
MACEFIELD, B. E. F., Reaction $U^{238}(d,p)U^{239}$, 18: 16912 (ANL-6848 (p.52-62))
MACHEKHIN, A. M., Investigation of ion drift in Wilson chamber by spark chamber, 18: 16335
MADDEN, R. P., Autoionization in He using synchrotron light source, 18: 16716
MADDOCK, A. G., Retention and annealing reactions in dichromates, 18: 16114
MADDOCK, A. G., Szilard-Chalmers process in dichromates, 18: 16115
MADSEN, V. A., Remarks concerning reciprocity in quantum mechanics, 18: 16802
MAEDA, H., Ionization drifts in ionospheric F region, 18: 16865
MAEDA, K., Conductivity of ionosphere and dynamo current system, 18: 16866
MAES, W., Movement of radioelements in soil, 18: 17341
MAGISTRELLI, F., Space charge aspects of r-f plasmoids, 18: 17238
MAGNAC-VALETTE, D., Decomposition of levels in Be-8, 18: 17022
MAGNAC-VALETTE, D., Study of low levels of Li-6 by $Li^7(He^3,\alpha)Li^6$, 18: 17031
MAGUIRE, Henry C., Effect of x-ray lymphopenia on contact dermatitis, 18: 15825
MAIBACH, Howard I., Effect of x-ray lymphopenia on contact dermatitis, 18: 15825
MAIENSCHEIN, F. C., Multicrystal γ spectrometer, 18: 16315
MAILLARD, R., Polarized deuterons of Saclay cyclotron, 18: 16617
MAILLET, Ennemond, Manufacture of tubular bodies with fins, 18: 16462
MAINSTONE, J. S., Micropulsation studies at Brisbane. II., 18: 16863
MAINSTONE, J. S., Micropulsation studies at Brisbane. I., 18: 16862
MAIOROV, V. V., Generation of transverse waves by directed explosions, 18: 17372 (UCRL-Trans-992(L))
MAKEPEACE, J. M., Reactivity behavior at Indian Point, 18: 17312
MAKSUMOV, R., Effects of nuclear emission on SiC luminescence, 18: 16122
MALLOZZI, P., Absorption coefficient and microwave conductivity of isotopic plasmas, 18: 17218
MALM, John G., Xenon tetroxide: preparation and properties, 18: 16052
MALSKY, Stanley J., Dose distribution in animals subjected to whole-body x irradiation, 18: 15753
MALVANO, Renzo, Determination of trace metals in petroleum, 18: 15968
MALYSHEV, A. V., Constants in nuclear physics. Handbook, 18: 17255
MALYSHEVA, T. V., Radiochemical analysis, 18: 15992
MAMONTOV, V. F., Control apparatus and shielding of fast pulsed reactor, 18: 17325 (NP-13710)
MANDELBERG, Hirsch I., Energy transfer in fast molecular ion collisions, 18: 16706
MANESSE, D., Nuclear reactions produced by Li-6 ions at 5 Mev, 18: 17007
MANFREDINI, S., Sorption of Sr-90 and Cs-137 in wheat, 18: 15761
MANGAN, R. A., TURBO*—two-dimensional depletion code, 18: 17280 (WCAP-6059)
MANI, G. S., Angular distribution and cross section for $Li^6(p,He^3)He^4$, 18: 17029
MANI, G. S., Determination of neutron cross sections, 18: 16970
MANI, G. S., Excited levels of Na-23 following α reactions on F-19, 18: 17001
MANI, G. S., Reactions (d,p) and (d,d) on C-12, 18: 16991
MANI, G. S., "Spin cutoff factor" and correlation energy for Si-29, 18: 16995
MANI, G. S., Study of levels of Be-8, 18: 17023
MANN, Joseph B., Ionization of U, UO, and UO_2 by electron impact, 18: 16088
MANN, W. B., Half life of C-14: comments on mass-spectrometric method,

18: 16961
MANNING, P. G., Extraction of Sc, 18: 16134
MANO, Koichi, Representations for nonrelativistic Coulomb Green's function, 18: 16416
MANSON-HING, L. R., X radiation in dental offices. II., 18: 16247
MANUS, C., Abnormal resistivity of plasma, 18: 17224
MAPLETON, R. A., Asymptotic form of electron capture cross section, 18: 16675
MAPPER, D., Determination of Rb and Cs in stony meteorites, 18: 15976
MARCHANT, H., Energy levels of Na-22, 18: 17055
MARCUS, F. R., Storing, packing, and transporting irradiated fuel elements, 18: 16238
MARDER, L., Space-times with bounded empty regions, 18: 16816
MAREI, A. N., Radiation hygiene. II. Public health, 18: 16252
MAREK, Ivo, Mathematical problems of theory of fast reactors, 18: 17288
MARGENAU, H., Absorption coefficient and microwave conductivity of isotopic plasmas, 18: 17218
MARGENAU, H., Absorption coefficient and microwave conductivity of isotopic plasmas, 18: 17218
MARGUIER, G., Internal conversion electrons of $Pm^{151} \rightarrow Sm^{151}$, 18: 17017
MARIOTTI, A., Influence of pan irradiation on plasma clearing, 18: 15879
MARK, Raymond, Anti-bovine serum albumin formation by transferred hyperimmune mouse spleen cells, 18: 15855
MARQUEZ, L., Gamma rays from reaction of Li-6 on Li-6, 18: 17006
MARQUEZ, L., Nuclear reactions produced by Li-6 ions at 5 Mev, 18: 17007
MARQUEZ, L., Study of reaction $Li^8 + Li^7 \rightarrow \alpha + Be^9$, 18: 17008
MARR, R. B., Lee model with four-point coupling, 18: 16778
MARRIOTT, R., Molecular collision cross sections, 18: 16679
MARSH, H. S., Index of Ionospheric Storminess, 18: 16845
MARSHALL, J. E., Deuterium-filled thyratron, 18: 16167
MARSHALL, N. H., Doppler broadening of total neutron cross sections of Pu-241, 18: 16942 (IDO-16954)
MARTIN, D. W., Mobilities of mass-indentified ions in N, 18: 16057
MARTIN, E. C., Use of copolymerized celluloses in chromatography, 18: 16145
MARTONE, M., Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)
MARTY, N., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
MARVAUD, J., Construction of generator of 14-Mev polarized neutrons, 18: 16902
MASCARENHAS, S., Annealing of the x-ray-induced volume expansion and coloration of LiF, 18: 16107
MASCARENHAS, S., Color center behavior of NaCl irradiated at low temperature, 18: 16106
MASSAROTTI, A., Deflector for Adone, 18: 16610 (LNF-63/72)
MASSIMILLA, L., Bubble motion in fluidized solid/gas systems, 18: 16181 (AERE-Trans-997)
MASSUE, J. P., Nuclear reactions produced by absorption of π^- mesons by light nuclei, 18: 16978
MASUDA, Yoshiko, Nuclear magnetic relaxation in Sc and La, 18: 16563
MATHER, K. B., Conjugate point relationships at high latitudes, 18: 16869
MATSUMOTO, H., Conductivity of ionosphere and dynamo current system, 18: 16866
MATSUMOTO, Shinji, Gamma rays from reaction $Si^{30}(p,\gamma)P^{31}$, 18: 17059
MATSUSHITA, S., Ionospheric variations during geomagnetic storms, 18: 16857
MATTSON, Rodney A., X-ray analyzer system, 18: 16292
MATUS, I., Free radicals formed in water radiolysis, 18: 16080
MAURER, W., Amount of β self-absorption in H-3 autoradiography, 18: 15928
MAUTE, Robert L., Process gas flow rate measurements with Xe-133, 18: 16387 (TID-7688(p.76-8))
MAY, Richard John, Protective clothing, 18: 16272
MAYER, M. S., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
MAYSENT, A. M., Physical aspects of electron therapy, 18: 15922
MAZELSKY, R., Superconductivity in Ge telluride, 18: 16888
MAZUREK, M., Vapor pressure measurements on D_2O–H_2O system, 18: 15974
MAZZA, L., Radiosensitivity of Walker tumors in hibernating rats, 18: 15878
MC AFEE, K. B., Drift velocities of ions in N, 18: 16058
MC CANDLESS, Esther L., Determination of S in polysaccharides, 18: 15965
MC CANN, P. H., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
MC CARROLL, R., Electron scattering by He positive ion, 18: 16682
MC CARTHY, C. R., Induced γ fading in neutron films, 18: 16359
MC CARTHY, I. E., Parity rule for inelastic scattering at small angles, 18: 16921 (ANL-6848(p.118-22))
MC CLAIN, J. W., Radiation stability of the Ar clathrate of hydroquinone, 18: 16084
MC CLURE, J. W., Determination of Fermi surfaces in graphite, 18: 16514
MC CUNE, James E., Superkinetic equation for spatially homogeneous plasmas, 18: 17196
MC CUSKER, C. B. A., Nucleon-nucleon collisions at 3000 Bev, 18: 16775
MC DANIEL, E. W., Mobilities of mass-indentified ions in N, 18: 16057
MC DOWELL, A. A., Comparisons of normal and irradiated monkeys, 18: 15853
MC DOWELL, A. A., Extinction by normal and whole-body irradiated monkeys, 18: 15852
MC DOWELL, A. A., Response latencies of normal and focal-head irradiated monkeys, 18: 15851
MC DOWELL, M. R. C., Ionization of excited states of H by electron impact, 18: 16691
MC DOWELL, M. R. C., Photodetachment from C^-, 18: 16715
MC FADDEN, P. L., Improved equipment design for studies on thyroid uptake, 18: 15919
MC GEARY, Robert K., Nuclear reactor fuel members, 18: 16449
MC GREGOR, W. K., Population of excited states in thermal plasma, 18: 17215
MC GREGOR, W. K., Thermal equilibrium in electrical discharges, 18: 17216
MC HENRY, J. R., Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
MC HENRY, R. E., Prog. rpt. on fission products, 10–11/62, 18: 16377 (ORNL-TM-515)
MC INNES, C. A. J., Determination of Rb and Cs in stony meteorites, 18: 15976
MC INTYRE, J. A., Neutron reduced widths by $N^{14}(N^{14},N^{15})N^{13}$ transfer reaction, 18: 16929 (ANL-6848(p.160-7))
MC KAY, Donald G., Pathologic anatomy of deuterium intoxication, 18: 15800
MC KAY, H. A. C., Nitrate complexes of U(IV), 18: 16029
MC KEE, D. W., Catalytic exchange of methane and deuterium, 18: 16034
MC KINNON, C. N., Physics of pulsed MHD generators, 18: 16743 (MHD-646)
MC LEOD, Margaret, Cataloging rules and practice of ORNL Library, 18: 17356 (ORNL-TM-579)
MC MILLIAN, W. I., Automatic temperature control reactors, 18: 17308
MC NICOL, R. W. E., Micropulsation studies at Brisbane. I., 18: 16862
MC NICOL, R. W. E., Micropulsation studies at Brisbane. II., 18: 16863
MC RARY, J. W., Analysis of $C^{14}(\alpha,n)O^{18}$ reaction, 18: 16937 (ANL-6848 (p.226))
MC VICAR, D. D., Excitation of He^+ by electrons, 18: 16681
McWHIRTER, R. W. P., Power loss from θ pinches by impurity radiation, 18: 17167
MEAKIN, John D., Interstitial loops in neutron-irradiated Mo, 18: 16536
MEDER, Werner, Radiation chemical thermal decomposition of hydrocarbons, 18: 16116
MEEDER, Raymond L., Radioactive source shielding device, 18: 16274
MEERT, M., Ionization accompanying disintegration of He-6, 18: 16988
MEGAW, W. J., Removal of I from gas streams, 18: 16033
MEHTA, M. K., Analysis of $Cr^{52}(d,p)Cr^{53}$ reaction, 18: 16913 (ANL-6848 (p.63-9))
MEHTA, O. P., Surface self-diffusion of adsorbed atoms, 18: 16479 (TID-7689(p.86-9))
MEINKE, W. Wayne, Radiochemical separation of Tl by amalgam exchange, 18: 16148
MEINKE, W. Wayne, Survey of photoneutron sources, 18: 16379
MEJDAHL, V., Induced γ fading in neutron films, 18: 16359
MEL'NIKOV, V. I., Fusibility diagram for NaF–KF–ZrF_4 system,

18: 16008 (ORNL-tr-31)
MENDELSSOHN, K., Time effects in superconductivity, 18: 16881
MENEELY, E. U., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
MENEELY, George R., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
MENNRATH, P., Double γ emission in monopolar transitions, 18: 16999
MENNRATH, P., Electromagnetic transition probabilities in O-16, 18: 16998
MENZEL, S., Megawatt-hour meter for reactor heat energy, 18: 17261 (ZFK-RN-8)
MERCHANT, H. C., Inertial load on plate under blast loading, 18: 17359 (SCL-TM-64-34)
MERCHEZ, F., Excitation of C-12 by scattering of neutrons, 18: 16967
MERMAZ, M., Cross sections from $Al^{27}(d,\alpha)Mg^{25}$ reactions, 18: 17072
MERRITT, W. F., Dilution in the Ottawa River. I., 18: 16196
MERVA, G. E., Removal of radioactive Sr from H_2O, 18: 16249
MERZBACHER, E., Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848(p.226))
MESHCHERYAKOV, R. P., Device for determining center of γ beam, 18: 16350
METZGER, P. H., Photoionization and absorption spectra of several gases, 18: 16718
MEURGUES, J. P., Source of Li ions, 18: 16615
MEY, Jacques, Developments in rapid nuclear electronics, 18: 16310 (SC-T-64-46)
MEYER, P., Prog. rpt. on pulsed neutron application to power reactor startup, 7–9/63, 18: 17297 (GEAP-4388)
MEYERAND, R. G., Jr., Comment on modified Penning arc plasma ejector, 18: 17123
MEYERHOF, W. E., Wigner cusp in F-19 total neutron cross sections, 18: 17069
MICHAELIS, Hans, Economic outlook for proven-type power reactors, 18: 17306
MICHALOWICZ, A., Parameters P and D in p-p scattering at 138 Mev, 18: 16772
MICHAUDON, A., Density functions in Rh-103 for "s" and "p" neutrons, 18: 17032
MIDDLETON, R., Energy levels of Ne-22, 18: 17055
MIDDLETON, R., Reaction $U^{238}(d,p)U^{239}$, 18: 16912 (ANL-6848(p.52-62))
MIEDEMA, A. R., Heat capacities of Tb and Ho, 18: 16516
MIELKE, Charles E., Radioactive source shielding device, 18: 16274
MIESCHER, Peter A., Symposium on immunopathology, La Jolla, Calif., 1/63, 18: 15754
MIHRAM, R. George, Fracturing information by use of radioisotopes, 18: 16194 (TID-7689(p.105-18))
MIHRAM, R. George, Uses of fluid tracers in oil wells, 18: 16192 (TID-7689(p.38-45))
MIKHAELYAN, V. M., Effects of radiation on Se crystallization, 18: 16540
MIKHAILOV, V. A., Track spark chamber, 18: 16327
MIKHAILOVSKAYA, L. V., Flute perturbations of plasma in helical magnetic field, 18: 17158
MIKHAILOVSKII, A. B., Flute perturbations of plasma in helical magnetic field, 18: 17158
MIKHALCHENKO, V. P., Roentgen interferences of W over range of 300 to 1100°K, 18: 16687
MIKUMO, T., Polarized deuterons of Saclay cyclotron, 18: 16617
MILFORD, S. N., Cosmic-ray hazards in the solar system, 18: 16735
MILLER, L., Self-diffusion in mixtures. VI., 18: 16054
MILLER, R. C., Superconductivity in Ge telluride, 18: 16888
MILLIKEN, M. Temple, Bibliography on refractory metal borides and nitrides, 18: 16481 (UCRL-7559)
MILLS, D. L., Ground-state occupancy of an ideal Bose-Einstein gas, 18: 16810
MILLS, F. E., Coherent vertical instabilities in MURA 50-Mev electron accelerator, 18: 16594 (BNL-7534(p.368-74))
MILLS, R. M., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
MINARDI, E., Energy principle for electrostatic stability of plasma, 18: 17161
MINARDI, E., Microstability conditions for plasma in a box, 18: 17162
MINASHIN, V. S., Heat exchange in transverse flow around tube bundles, 18: 16175 (NP-13712)
MINOWADA, J., Effect of x irradiation on DNA synthesis, 18: 15835
MIRO, Milagros, Effect of $CuSO_4$ on ceric dosimetry system, 18: 16318
MIRSHAMSI, Morteza, Diffusion phenomena in liquid Cd–Pb binary system, 18: 16480 (TID-20326)
MITANI, Kenji, Microwave radiation from plasma. I., 18: 17147
MITANI, Kenji, Microwave radiation from plasma. II., 18: 17148
MITCHELL, V. E., Chromatography of nucleic acids, 18: 15780 (LAMS-3034(p.350-72))
MITTELMAN, P. S., Using γ transmission to determine shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))
MJOLSNESS, R. C., Solvability of Bogoliubov kinetic theory for plasmas, 18: 17102 (AD-431025)
MOELLER, H. G., Disturbances of pulse radio transmission, 18: 16840
MOFFATT, J. G., Synthesis of γ-P^{32}-labeled adenosine 5'-triphosphate, 18: 16085
MOGHISSI, A., Change of tritiated water in hydrocarbon, 18: 16073
MOHANTY, S. R., Annealing of chemical radiation damage, 18: 16103
MOIR, Douglas Newlands, Improvements in beneficiation of Be ores, 18: 16154
MOLHO, N., Cross section for production of H atoms in the 2S state, 18: 16704
MOLITOR, J. H., Optimization of ion engine control systems, 18: 16582
MONTEROSSO, R., Spatio-temporal diffusion equation in two-group approximation, 18: 16890 (EUR-596.e)
MONTGOMERY, P. O'B., Subcellular effects of x irradiation, 18: 15864
MOORE, Fletcher L., Nondestructive method for determination of Cf-252, 18: 15969
MOORE, J. A., Ternary fission of U-235 by slow neutrons, 18: 17003
MOORE, Wellington, Jr., Metabolism of Ba-133 and Ca-45 by embryonic bone, 18: 15803
MOORE, William H., Jr., Effects of heavy high-energy charged particles. I., 18: 15826
MOORE, William H., Jr., Effects of heavy high-energy charged particles. III., 18: 15828
MOREAU, R., Problems posed by treatment of nuclear physics data, 18: 16322
MORELLET, D., Pion-nucleon cross section, 18: 16776
MORELLET, D., Statistics and application, 18: 16408 (CERN-64-13(Vol.I) (p.1-86))
MORET, R., Double-focusing electrostatic spectrometer for low-energy electrons, 18: 16325
MORETTI, S., Joint AN/CNEN/NPPC irradiation program, 18: 17328
MOREWITZ, H. A., Critical U fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
MORGAN, A. D., Height distortion of peak of E region, 18: 16864
MORGAN, C. G., Secondary ionization processes in He, 18: 16677
MORGAN, Karl Z., Hazard of radioactive materials, 18: 16241
MORGENSTERN, J., Interaction of resonance neutrons with nuclei. I., 18: 17033
MORGENSTERN, J., Interaction of resonance neutrons with nuclei. II., 18: 17034
MORGENSTERN, J., Interaction of resonance neutrons with nuclei. III., 18: 17035
MORGENSTERN, J., Interaction of resonance neutrons with nuclei. IV., 18: 17036
MORI, Masatake, Crystallite size distribution of γ-irradiated polyethylenes, 18: 16099
MORINIGO, Fernando B., Coulomb-wave stripping amplitudes, 18: 16910 (ANL-6848(p.38-42))
MORITO, Nozomu, Multiple dispersion mass spectrometer, 18: 16291
MORONI, J. P., Rapid determination of I-131 in milk, 18: 15959 (SCPRI(S)-94)
MOROSHKINA, T. M., Spectral determination of small quantities of Hf and Th in natural materials, 18: 15991
MOROZOV, A. M., Production of thin Ti–D and Ti–T targets, 18: 16461
MORPURGO, G., Theory of Coulomb photoproduction of π^0, 18: 17063
MORRIS, J. B., Removal of I from gas streams, 18: 16033
MORRIS, J. C., Continuum radiation from arc-heated plasmas, 18: 17135
MORTIER, P., Mobility of positive ions in Geiger discharges, 18: 16351
MOSBURG, E. R., Jr., Non-linear ambipolar diffusion across a magnetic field, 18: 17226

MOSCATELLI, V., Chromatography on ion exchange papers. X., 18: 16140
MOSES, R. A., Equation of state for *para* hydrogen, 18: 16654
MOSS, A. J., Jr., Influence of sugars on radiation sensitivity of catalase, 18: 15900
MOSTOVAYA, T. A., Mass distributions of heavy fragments by pulse analyzer, 18: 16338
MOSTOVOI, V. I., Mass distributions of heavy fragments by pulse analyzer, 18: 16338
MOTOJIMA, Kenji, Potentiometric titration of free acid and U in U(VI) solution, 18: 15966
MOULIN, Thiebaut, Basic measurements in a rail-type plasma gun, 18: 17131
MOUSSA, A., Double-focusing electrostatic spectrometer for low-energy electrons, 18: 16325
MOUSSA, A., Internal conversion coefficients of Eu-153 transitions, 18: 17016
MOUSSA, A., Internal conversion electrons of $Pm^{151} \rightarrow Sm^{151}$, 18: 17017
MOYE, C. J., Kinetic studies using radiochromatography on thin layers. I., 18: 16138
MUEHRICKE, Robert C., Observations in radiation nephritis, 18: 15862
MUELLER, M., Does N mustard mimic x-ray effects? 18: 15834
MUENZEL, H., Apparatus for fast liquid-liquid extraction, 18: 16146
MUKHIN, K. N., Equipment for processing bubble chamber photographs, 18: 16336
MULLAN, A., Nuclear needle for neurosurgery, 18: 15912 (ACRH-20 (p.25-36))
MULLAN, S., Percutaneous cordotomy for pain, 18: 15734 (ACRH-20 (p.37-46))
MUMINOV, M., Absorption of γ rays by burnt bricks, 18: 17245
MUNOZ, F. J., Effect of $CuSO_4$ on ceric dosimetry system, 18: 16318
MUNSHI, Kailash N., Metal chelates of rare earths. I., 18: 16039
MURATOV, V. I., High-frequency oscillations of plasma in magnetic field, 18: 17109 (NP-13612)
MURPHY, E. A., Prog. rpt. on Be wire, 12/6/63--2/6/64, 18: 16451 (AD-432273)
MURPHY, R. S., Index of Ionospheric Storminess, 18: 16845
MURRAY, A., Chromatography of nucleic acids, 18: 15780 (LAMS-3034 (p.350-72))
MURRAY, H. W., Structural problems in reactor engineering, 18: 17262
MURTHY, S. N. B., Analysis of arc-heating phenomena in tube, 18: 17132
MUTO, Jiro, Scattering of α particles by medium-weight nuclei, 18: 17046
MUYSKEN, M., Critical facility KRITO, 18: 17276 (EUR-498.e)
MUZZARELLI, R. A. A., Determination of Cd, Y, Sc, and lanthanons in U metal, 18: 15950 (EUR-587.e)
MYERS, Dale H., Radiation exposure from radioiodine, 18: 15939
MYERSCOUGH, V. P., Photodetachment from C^-, 18: 16715

N

NAGATA, T., Extra-terrestrial corpuscular streams, 18: 16871
NAIR, V., Use of S^{35}-acetazolamide in blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))
NAKJIMA, Yutuko, Gamma rays from reaction $Si^{29}(p,\gamma)P^{30}$, 18: 17059
NAKKEN, Karl Ford, Action of x rays on dilute solution of *p*-aminobenzoic acid, 18: 16110
NAMIKI, Tsuneo, Histopathological studies on radiation pneumonitis, 18: 15889
NARIBOLI, G. A., Sonic discontinuities in MHD, 18: 16560
NASSIFF, S. J., Isotopic exchange of Fe between FeCl, and Fe cupferrate, 18: 16402
NATHANS, R., Neutron magnetic scattering from f.c.c. Fe alloys, 18: 16506
NAYLOR, L., Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)
NAZAROV, N. I., Cherenkov absorption of "whistles" in plasma cylinder, 18: 17153
NAZAROV, N. I., Cherenkov damping of h-f plasma oscillations, 18: 17154
NEARY, G. J., Fast proton source for radiobiology, 18: 15866
NEFEDOV, V. V., Scintillation γ spectrometer with fast neutron discrimination, 18: 16329
NEILL, J. M., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)

NELSON, Bill, Demonstration of delayed excretion of Fe-59, 18: 15934
NELSON, P., Instabilities due to radiation, 18: 17203
NELSON, Robert S., Use of P-32 to detect neoplasia of G-I tract, 18: 15929
NEMILOV, Yu. A., Differential cross section for proton groups from $Al^{27}(d,p)Al^{28}$, 18: 17091
NEMILOV, Yu. A., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092
NEMILOV, Yu. A., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
NESTEROV, V. G., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
NETTER, F., Interaction of resonance neutrons with nuclei. I., 18: 17033
NETTER, F., Interaction of resonance neutrons with nuclei. II., 18: 17034
NETTER, F., Interaction of resonance neutrons with nuclei. III., 18: 17035
NETTER, F., Interaction of resonance neutrons with nuclei. IV., 18: 17036
NEUHAUS, H., Spectra of PdH and PdD, 18: 16575
NEUMANN, H. G., Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
NEVE DE MEVERGNIES, M., Determination of spin resonances in $Sm^{149} + n$, 18: 17037
NEVE DE MEVERGNIES, M., Excited levels in Tm-169, 18: 16982
NEVE DE MEVERGNIES, M., Scattering of cold neutrons by protons, 18: 17081
NEWCOMB, H. R., Radiosensitivity of dehydrogenases and transaminases, 18: 15845
NEYFAKH, A. A., Radiation investigation of nucleo-cytoplasmic interrelations, 18: 15867
NGOC, H. Nguyen, Electrodisintegration of Be-9, 18: 17024
NICKLESS, G., Quantitative inorganic chromatography. XI., 18: 16142
NICOLAS-LINCK, I., Study of low levels of Li-6 by $Li^7(He^3,\alpha)Li^6$, 18: 17031
NIELSEN, T. H., Thermal expansion of yttria-stabilized zirconia, 18: 16500
NIEMIEC, J., X-ray analysis of Tc alloys, 18: 16489
NIESE, S., Sodium determination in Si and SiO_2, 18: 15981
NIEWODNICZANSKI, H., Polarization of neutrons from $D(d,n)He^3$, 18: 16992
NIEWODNICZANSKI, H., Scattering of deuterons on Si-28 and excitation of core of Al-27, 18: 17021
NIJS, W. W., Critical facility KRITO, 18: 17276 (EUR-498.e)
NIKITIN, V. A., $(CH_2)n$ thin films as synchrocyclotron targets, 18: 16794
NIKOLAENKO, V. A., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
NIKOLAEV, A. V., Solubility of U peroxide, 18: 16012
NIKOLAEV, M. N., Group cross sections of nuclear reactions used for recording neutrons, 18: 16947 (NP-13661)
NIKOLAEV, M. N., Group constants of fast and intermediate neutrons for designing reactors, 18: 17287 (NP-13666)
NIKOLEYCHVILI, U. D., Charge exchange between ions and atoms of alkaline and alkaline-earth metals, 18: 16727
NISHIHARA, H., Immunogenicity of irradiated *Mycobacterium tuberculosis*, 18: 15824
NIYAZOVA, O. R., Effects of x and γ radiation on structural changes in CdS, 18: 16125
NIZHIN, G. Ya., Vacuum gage using a-c gas discharge, 18: 16278 (NP-13717)
NOBATSKII, B. G., Reactions (d,p) and elastic scattering (d,d) on nuclei. II. 18: 17093
NODA, Tomotsu, Multiple dispersion mass spectrometer, 18: 16291
NOELLER, Hans-Georg, Separation of gas mixtures, 18: 16156
NOGAMI, Yozo, Gamma rays from reaction $Si^{29}(p,\gamma)P^{30}$, 18: 17059
NOLAND, B. J., Ultracentrifugal sedimentation-velocity molecular weight data for DNA, 18: 15778 (LAMS-3034(p.319-25))
NOMOFILOV, A. A., $(CH_2)n$ thin films as synchrocyclotron targets, 18: 16794
NORIN, Marvin P., Radioisotope-powered underwater acoustic beacon, 18: 16397 (TID-7689(p.72-6))
NORTON, F. J., Catalytic exchange of methane and deuterium, 18: 16034
NORTON, L. J., Technetium compounds with the $MgZn_2$ structure, 18: 16535
NORTON, R. B., Model of atmosphere and ionosphere in E and F1 regions, 18: 16850
NOTTAGE, Herbert B., Effect of neutron irradiation upon Ge films, 18: 16532

NOVCIC, Desanka, Ultrasonic decontamination, 18: 16250
NURIEV, A. N., Leaching-out U and Ra from clays, 18: 16133
NURZYNSKI, J., Scattering of deuterons on Si-28 and excitation of core of Al-27, 18: 17021
NUSSBAUM, Elmer, Diffusion of radioactive gases through films, 18: 16550 (TID-7688(p.64-7))

O

OBAYASHI, Tetsuzo, Ionospheric polar blackouts, 18: 16826
OBERMAN, Carl R., Breakdown of He in stellarator by magnetic pumping, 18: 17156
O'BRIEN, R. D., Radiation, radioactivity, and insects, 18: 15756
OBRINK, K. J., Recording of rapidly changing radioactive counting rates, 18: 16311
OCHS, A., Radio propagation disturbances, 18: 16843
OCKER, H.-D., Bread production with radioactive contamination of raw materials, 18: 15906
O'CONNER, J. R., Theory of thermoluminescence of fluorite (CaF_2:Y), 18: 16557
ODARTCHENKO, N., Mitotic delay in erythroblasts of the dog, 18: 15874
OEHMIGEN, A., Megawatt-hour meter for reactor heat energy, 18: 17261 (ZFK-RN-8)
OERTEL, D., Temperature field calculation, 18: 16185
OGATA, Hiroshi, Scattering of α particles by medium-weight nuclei, 18: 17046
OGUTI, T., Extra-terrestrial corpuscular streams, 18: 16871
OHARA, Yoji, Production of CoF_3, 18: 17374 (UCRL-Trans-1043(L))
OHMART, Philip Edwin, Improvements in ionization chambers, 18: 16370
OHNUKI, Yasushi, Chromosomal studies on irradiated human leukocytes, 18: 15840
OKEN, Donald, Mental preparedness of emergency personnel, 18: 16270
OKOLOVICH, V. N., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
OKUDA, T., Dynamic properties of Langmuir probes. I., 18: 17182
OKUDA, T., Dynamic properties of Langmuir probes. II., 18: 17183
OKULOV, B. V., Mechanism of electron capture, without oscillations, into acceleration in betatron, 18: 16622
OKUMA, Yasuhiko, Scattering of α particles by medium-weight nuclei, 18: 17046
OLINER, Leo, Thyroidal and extrathyroidal hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))
OLIVER, R., Method for investigation of stem-cell kinetics, 18: 15833
OLIVER, Rudolph W., Cerium monosulfide articles, 18: 16437
OLIVERIO, A., Thyroid capture of I-131 in the rat, 18: 15789
OLKOWSKY, J., Determination of neutron cross sections, 18: 16970
OLSEN, J. L., Superconducting In–Pb alloys, 18: 16884
OLSON, J. S., Landscape investigations using Cs-137, 18: 15762
OMDVAR, K., Electron impact ionization of H, 18: 16693
OMS, J., Determination of intensity of γ transitions by external conversion, 18: 16320
O'NEILL, G. K., Experimental results from Stanford electron storage ring, 18: 16595 (BNL-7534(p.375-8))
O'NEILL, G. K., Storage-ring work at Stanford, 18: 16587 (BNL-7534 (p.209-27))
ONG, S. G., Cosmic radiation and tuberculosis. V., 18: 15882
ONG, S. G., Cosmic radiation and tuberculosis. VI., 18: 15883
ONG, S. G., Cosmic radiation and tuberculosis. VII., 18: 15884
ONSTOTT, E. I., Extraction of lanthanons from electrolytes with Li amalgam, 18: 15945 (LADC-6084)
OPPENHEIM, I., Preservation of canonical distribution in Markovian relaxation processes, 18: 16417
ORCE, Luis V., Radioresistance of *E. coli*, 18: 15898
ORE, Aadne, Relative frequencies of ion clusters, 18: 16109
ORKIN-LECOURTOIS, A., Pion-nucleon cross section, 18: 16776
ORLOV, V. V., Efficiency of system of absorber-type rods, 18: 17259 (NP-13659)
ORLOV, V. V., Theory of resonance absorption of neutrons in media, 18: 16895 (NP-13662)
ORLOV, Yu. M., Group cross sections of nuclear reactions used for recording neutrons, 18: 16947 (NP-13661)
ORMONDE, Stephan, Motion of fission fragments from HA explosions, 18: 16213
O'ROURKE, R. G., Prog. rpt. on Be wire, 12/6/63–2/6/64, 18: 16451 (AD-432273)
ORSONI, L., Fast multiplication factor in cylindrical symmetry, 18: 17282 (CEA-tr-X-319)
ORTNER, Johannes, Influence of solar disturbances on vlf radio waves, 18: 16830
ORTNER, Johannes, Influence of solar flares on transarctic h-f radio propagation, 18: 16831
OSBORN, G. K., Effect of age on radiation-induced polydipsia in rat, 18: 15815 (USNRDL-TR-712)
OSBORNE, J. W., Rhesus monkeys immunized against *Schistosoma japonicum* by administration of x-irradiated cercariae, 18: 15890
OSKAM H. J., Dynamic properties of Langmuir probes. I., 18: 17182
OSKAM, H. J., Dynamic properties of Langmuir probes. II., 18: 17183
OSMOND, W. P., Exchange interactions in $Nb_2Mn_4O_9$ and $Nb_2Co_4O_9$, 18: 16048
OSOCHINIKOV, A. A., Mass distributions of heavy fragments by pulse analyzer, 18: 16338
OSOSKOV, G. A., Singularities in multichannel detection devices, 18: 16340
OSSICINI, L., Chromatography on ion exchange papers. IX., 18: 16139
OSTER, Ludwig, Thermodynamic equilibrium in fully ionized gas, 18: 17209
OSTIDICH, A., Preparation of F-18 in nuclear reactor, 18: 16111
OSTRIHANSKY, Lubor, Effect of fallout on radiometric field measurements in prospecting, 18: 16220
OTT, D. G., Nucleic acids: automated base analysis, 18: 15954 (LAMS-3034(p.313-18))
OTT, D. G., Oligonucleotide synthesis, 18: 15779 (LAMS-3034(p.329-49))
OTT, D. G., Representation of oligonucleotides, 18: 15745 (LAMS-3034 (p.326-8))
OWENS, Charles W., Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))
OWREN, L., Multiple scattering in the auroral ionosphere, 18: 16875
OWREN, Leif, Influence of solar particle radiations on arctic h-f propagation, 18: 16825
OZIZMIR, Ercument, Algebraic structure of cluster expansions in statistical mechanics, 18: 16412 (CNAEM-14)

P

PACKER, L. L., Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
PADGETT, D. W., Exchange magnetic moment in three-body nuclei, 18: 17074
PADMANABHAN, V. M., Analysis of H-bonded crystals, 18: 16055
PAGES, A., Problems posed by treatment of nuclear physics data, 18: 16322
PAIN, H. J., Conduction between electrodes in shock-heated Ar, 18: 17222
PAINTER, Robert B., Use of labeled thymidine in cell culture studies, 18: 15802
PAK, M. I., Argon-filled spark chambers, 18: 16337
PAK, M. I., Investigation of ion drift in Wilson chamber by spark chamber, 18: 16335
PAL, L., Determination of $\beta^{\pi\pi}/1$ on ZR-1 assembly, 18: 17284
PALLISTER, E. T., Radium-226 content of natural waters and coal in New South Wales, 18: 16211
PALMAS, G., Sorption of Sr-90 and Cs-137 in wheat, 18: 15761
PALMER, R. H., Fever-producing action of steroids, 18: 15755
PAL'MIN, V. V., Changes in properties of meat by irradiation, 18: 16381 (NP-13619)
PALMITER, C. C., Federal Radiation Council protection guides, 18: 15911
PANASYUK, I. S., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
PANENKA, Jaroslav, Effect of fallout on radiometric field measurements in prospecting, 18: 16220
PANKOVA, Helena, Separation of Zr^{95}–Nb^{95} from fission product solution, 18: 16144
PANOV, M. N., Energy losses in single collisions of atomic particles, 18: 16710

PANTUEV, V. S., Cherenkov spectrometer for measuring γ energy, 18: 16330

PAPADOPOULOS, J., Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))

PAPAIOANNOU, S. E., Radiation-induced changes in milk fat, 18: 15848

PAPINEAU, A., Polarized deuterons of Saclay cyclotron, 18: 16617

PAPINEAU, L., Cross sections from $Al^{27}(d,\alpha)Mg^{25}$ reactions, 18: 17072

PAPINEAU, L., Partial excitation functions for $V^{51}(p,n)Cr^{51}$ reactions, 18: 16996

PARANJAPE, V. V., Decrease of electron temperature by electric fields, 18: 16882

PARK, J. Y., Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848 (p.226))

PARRY, J. R., Radiolysis of cyclohexane, 18: 16102

PARSONS, T. F., Prog. rpt. on anti-radiation drugs, 10–12/63, 18: 15895 (NP-13730)

PARVIS, V. Prete, Lipid component of arterial elastica, 18: 17373 (UCRL-Trans-1033)

PARZEN, Philip, Effect of ion engine exhaust on telemetry systems, 18: 16286

PASECHNIK, M. V., Elastic scattering of 0.65-Mev neutrons, 18: 17089

PASTOR, L., Two levels of Ru-101, 18: 17014

PATERSON, Ian Laird McKenzie, Self-engaging couplings, 18: 16169

PATTERSON, Paul, Reaction rates for the formation of He_2^+ and Ne_2^+, 18: 16722

PAVLENKO, P. D., Converter-switch apparatus for pulse extraction from Geiger counters, 18: 16345

PAVLOTSKAYA, F. I., Radiochemical analysis, 18: 15992

PAVLOVIC, Bosko, Ultrasonic decontamination, 18: 16250

PAVONE, Daniel, Solution calorimeter, 18: 16276 (LA-3031)

PAWLOWICZ, A. T., Electron-diffraction patterns from solid D, 18: 16576

PAXTON, H. W., Diffusion in B.C.C. metals, 18: 16474 (NP-13738)

PEACOCK, R. D., New noble gas compounds, 18: 16050

PEAK, J. C., Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)

PEAK, L. S., Nucleon-nucleon collisions at 3000 Bev, 18: 16775

PEARSON, Cynthia A., Determining Be in oil-field waters, 18: 15967

PEARSON, Gary A., Heating of electrons in crossed fields, 18: 17214

PEASE, L. F., Zirconium–W–Ta system, 18: 16503

PECKHAM, Alan E., Movement of radionuclides in the earth environment, 18: 16207

PEDENKO, N. S., Excitation of oscillations by electron beam in plasma, 18: 17112 (NP-13697)

PEDERSON, Raymond A., Comparison of neutron dose rates, 18: 16299 (LAMS-2977)

PEDROCCHI, E., High-pressure facility for hydrodynamics e[illegible]e two-phase flow, 18: 16170 (EURAEC-896)

PEHL, R. H., Strongly populated levels of $(d_{5/2})^{\frac{1}{2}}$ and $(f_{7/2})^{\frac{1}{2}}$ con[illegible]a in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))

PEHL, Richard H., Reactions (p,t), (p,He^3), and (p,α) on O-16, 18: 16936 (ANL-6848(p.208-16))

PEIRSON, D. H., Automation of photographic dosimetry, 18: 16360

PEKAREK, L., Theory of moving striations in a d-c discharge plasma. II., 18: 17124

PEKER, L. K., Decay scheme of radioactive nuclei $A \geq 100$, 18: 17099

PELLERIN, P., Rapid determination of I-131 in milk, 18: 15959 (SCPRI(S)-94)

PELLICCIONI, P., Measurement of fast neutron flux by means of a non-directional counter, 18: 16362

PENGELLY, R. M., Recombination spectra. I., 18: 16631

PENGELLY, R. M., Recombination spectra. II., 18: 16632

PENNDORF, R., Arctic communications following solar disturbances, 18: 16841

PEPPER, Francis D., Reliability of radioisotopic encephalography, 18: 15937

PERCY, Moira, Deoxyribonucleic acid polymerase in L Cells. II., 18: 15831

PEREY, F. G., Elastic scattering of 17-Mev protons from heavy nuclei, 18: 16920 (ANL-6848(p.114-17))

PEREZ Y JORBA, J., Electrodisintegration of Be-9, 18: 17024

PERKINS, W. H., Influence of sugars on radiation sensitivity of catalase, 18: 15900

PERL, John I., Intraluminal β irradiation in leukoplakia, 18: 15935

PERLIN, A. S., Vapor pressure measurements on D_2O–H_2O system, 18: 15974

PERRIN, A., Total cross section of Ni for neutrons of 175 to 300 kev, 18: 17038

PERRIN, N., Disintegration Pa-231 → Ac-227, 18: 16985

PERRIN, N., Lifetime of first excited level of Gd-152, 18: 16986

PERRIN, N., Two levels of Ru-101, 18: 17014

PERRIN, P., Excitation of C-12 by scattering of neutrons, 18: 16967

PERSIANTSEVA, V. P., Inhibiting properties of pertechnetate ion, 18: 16443 (ORNL-tr-32)

PERSSON, K.-B., Non-linear ambipolar diffusion across a magnetic field, 18: 17226

PESHIKOV, E. V., Effects of γ radiation on dielectric properties of triglycine sulfate crystals, 18: 16124

PESHKOV, E. V., Effects of intrinsic field shift in irradiated seignetto salt crystals, 18: 16545

PESKIN, Richard L., Mean flow characteristics of gas-solid suspensions, 18: 16176 (NYO-2930-1)

PETERLE, Tony J., Prog. rpt. on effects of insecticide on ecology of fauna, 12/60–11/63, 18: 17362 (TID-20355)

PETERLONGO, G., Critical heat flux and pressure drop measurements in round vertical tubes, 18: 16172 (EURAEC-951)

PETERSEN, D. F., Chromatography of nucleic acids, 18: 15780 (LAMS-3034(p.350-72))

PETERSON, A. M., Influence of sudden ionospheric disturbances, 18: 16836

PETIT, G. Y., Scattering of 14-Mev neutrons by C-12: excited states, 18: 16968

PETRES, J., Source of Li ions, 18: 16615

PETRESCU, Doria, Changes in immunity due to ionizing rays, 18: 15881

PETROV, Yu. K., Effect of sector-angle dynamics on operation of weak-focusing accelerator, 18: 16623

PETRUSEK, Ruby, Nitric oxide protection of bacteriophage against x-irradiation damage, 18: 15901

PETSCHEK, H. E., Aerodynamic aspects of magnetospheric flow, 18: 16629 (AD-430410)

PETZOLD, A., Dependence of sheet metal surface roughness on pretreatment, 18: 16457 (AI-Trans-41)

PFIRSCH, D., Multi-time-scale formalism in weak coupling theory, 18: 16817

PFOHL, Raymond, Compound nuclei and tangential collisions in reactions of Ne 20 with Ag and Br, 18: 17010

PHILLIPS, G. C., Reactions (He^3,n), 18: 16935 (ANL-6848(p.199-207))

PHILLIPS, J. L., Chemical problems at Dounreay, 18: 17310

PHILLIPS, Norman E., Heat capacities of Ga, Cd, and Cu, 18: 16886

PHIPPS, C. M., Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))

PICARD, J., Cross sections for (n,p), (n,α), and (n,2n) on F-19 and Na-23, 18: 16969

PICARD, J., Inelastic scattering of 14.1-Mev neutrons by S-32, 18: 16972

PICINBONO, B., Simple model of stripping reaction on Be-9 and N-14, 18: 17053

PICKART, S. J., Neutron magnetic scattering from f.c.c. Fe alloys, 18: 16506

PIFFAULT, C., Radioprotection and Lazarew's reaction, 18: 16081

PIKEL'NER, S. B., Fundamentals of cosmic electrodynamics, 18: 17122 (NASA-TT-F-175)

PINAJIAN, J. J., Oak Ridge National Laboratory 86-in. cyclotron program, 18: 16399 (TID-7688(p.5-7))

PINSLEY, E. A., Comment on modified Penning arc plasma ejector, 18: 17123

PINSLEY, Edward A., Surface contact Hall-current accelerator, 18: 16559

PIRANI, Conrad L., Observations in radiation nephritis, 18: 15862

PIRT, L., Bubble motion in fluidized solid/gas systems, 18: 16181 (AERE-Trans-997)

PISKORZH, Sh., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092

PIXLEY, R. E., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000

PLANTEVIN, J.-P., Calculation of equation of state of H, 18: 16056

PLEMNEX, V. D., Invariants of motion of charged particle in stationary

heterogeneous magnetic field, 18: 16553 (FTD-TT-64-90(p.80-109))
PLESS, I. A., Use of large, heavy-liquid chamber at high-energy accelerators, 18: 16294 (BNL-7534(p.113-27))
PLETNEV, V. D., Density distribution and intensity of charged particles, 18: 16731 (FTD-TT-64-90(p.110-27))
PLUHAR, Z., Perturbation theory for system of many fermions, 18: 16800
PLUMMER, A. M., Conversion of α particle energy into electricity, 18: 16745
PODYORGIN, V. A., Reduction of La and Ce oxides by Al, 18: 16430
POGGI, R., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
POLLARD, F. H., Quantitative inorganic chromatography. XI., 18: 16142
POMELAS, E., Total cross sections of Na, Th, and U for neutrons, 18: 16973
POMERAT, C. M., Chromosomal studies on irradiated human leukocytes, 18: 15840
POOL, M. L., Potentials of isotopic radiography, 18: 15918 (TID-7689 (p.29-30))
POORTMANS, F., Determination of spin resonances in $Sm^{149} + n$, 18: 17037
POPESCU, Iovitzu, Movement of positive ions in inhomogenous electric field, 18: 17221
POPESCU, Iovitzu, Resonant charge transfer in ionized dense gases, 18: 16725
POPKOV, K. K., Space distribution of dose streams of capture γ radiation, 18: 16962
POPOV, V. A., Cross section of collisions of electrons with neutral atoms, 18: 16702
POPOV, V. A., Properties of slightly ionized gaseous mixtures, 18: 16062
POPPENDIEK, H. F., Prog. rpt. on high acceleration field heat transfer for SNAP, 9-11/63, 18: 16177 (TID-20133)
POPPENDIEK, H. F., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62-8/63, 18: 17322 (TID-19971)
POREMBKA, Stanley W., Prog. rpt. on D_2O-moderated reactors, 12/63-2/64, 18: 16467 (BMI-X-277)
PORT, M., Excited levels in F-19 by study of $O^{18}(p,\alpha_0)N^{15}$, 18: 17030
PORTAL, G., Fast neutron dosimetry using proton recoil emulsions, 18: 16357
PORTER, William S., Hydrogen energy levels: perturbation caused by proton structure, 18: 16686
PORTNOI, K. I., Interaction in systems refractory metal-C-N, 18: 16498
POTTER, D. L., Characteristic x-ray production in the L shell of Cu, 18: 16663
POTTER, J. Leith, Gasdynamic diagnosis of flows from plasma states, 18: 17136
POULET, M., Parameters P and D in p-p scattering at 138 Mev, 18: 16772
POULET, M., Study of $C^{13}(p,2p)B^{11}$ reaction with propane bubble chamber, 18: 17045
POULHEIM, K. F., Human-body counter, 18: 16244
POUNDS, K. A., Results from the x-ray spectrometer in satellite UK1, 18: 16645
POUNDS, K. A., Rocket measurements of the sun's x-ray tail, 18: 16640
POUTCHEROV, N., Parameters P and D in p-p scattering at 138 Mev, 18: 16772
PRANOWO, Extraction of Sc, 18: 16134
PRAVDYUK, N. F., Mechanical properties of construction materials under neutron radiation, 18: 16525 (NP-13657)
PRAVDYUK, N. F., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
PRAVIDIVI, N. M., Elastic scattering of 0.65-Mev neutrons, 18: 17089
PREUSS, L. E., Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
PREUSS, L. E., Tracer study of vacuum distillation and thin film deposition, 18: 16386 (TID-7688(p.40-3))
PREUSS, Luther E., Use of isotopes in ring and linear vacuum distillation source studies, 18: 16000 (TID-7689(p.96-103))
PRICE, R. B., Filter efficiency in removal of oil mist from compressed air, 18: 16388 (TID-7688(p.78-80))
PRICE, Thomas, Production of C masses, 18: 16464
PRIESS, S., Multi-time-scale formalism in weak coupling theory, 18: 16817
PRIMBSCH, E., Amount of β self-absorption in H-3 autoradiography, 18: 15928
PRITCHARD, H. O., Exponential correlation functions for two-electron atoms, 18: 16655
PRO, M. J., Application of activation analysis to forensic science. II., 18: 15977
PROCTOR, Gene, System to obtain data on population exposure to x rays, 18: 16248
PROSDOCIMI, A., Fission cross section of Pu-239, 18: 17002
PROTAS, J., Hydrated U oxides, 18: 16009
PROWSE, D. J., Isotopic spin of the η meson, 18: 16783
PRUGOVECKI, Eduard, Multiplicative symmetries in axiomatic quantum field theory, 18: 16803
PRYOR, Gordon T., Brain serotonin and behavior in rats, 18: 17364 (UCRL-11179)
PUCHKOV, B. I., Influence of plastic deformation and heat treatment on Be bronze, 18: 16497
PUCHOT, H., Vitamin B_{12} therapy of postradiotherapeutic hematological complications, 18: 15902
PUGACHEVA, T. S., Fast particle energy losses on excitation of atomic oscillations, 18: 16544
PUGACHEVA, T. S., Radiation-induced diffusion activation in solids, 18: 16543
PUGLISI, M., Deflector for Adone, 18: 16610 (LNF-63/72)
PULATOV, U. V., Effects of h-f discharge on adsorption properties of silica gels and zeolites, 18: 16117
PURICA, I. I., Reactor physics carried out with 3-Mw VVR-S reactor and RUICO-1 subcritical assembly, 18: 17286
PURSER, F. O., Neutron polarization and cross sections for $C^{13}(d,n)N^{13}$ reaction, 18: 16908 (ANL-6848(p.16-23))
PUTIRSKAYA, G. V., Free radicals formed in water radiolysis, 18: 16080
PYR'EV, M. F., Separation of lanthanides in NH_4NO_3 by zone crystallization. III., 18: 16137

Q

QUEBERT, J. L., Nuclear reactions produced by Li-6 ions at 5 Mev, 18: 17007
QUESNE, C., Scattering of α particles by light nuclei, 18: 17019
QURESHI, Iqbal H., Radiochemical separation of Tl by amalgam exchange, 18: 16148

R

RABINOWITZ, M., Inhibition of RNA polymerase by 6-azauridine triphosphate, 18: 15751
RABY, Bruce Alan, Chemical analysis of alkali metal W bronzes, 18: 15952 (IS-800)
RADVANYI, P., Study of Ca-40, B-11, and B-10 by (p,d) reaction, 18: 17043
RAHSHTADT, A. G., Influence of plastic deformation and heat treatment on Be bronze, 18: 16497
RAI, Kanti, Labeling of human globulin with I-124, 18: 15933
RAI, Kanti R., Effects of heavy high-energy charged particles. II., 18: 15827
RAINE, Thomas, Beryllium alloys, 18: 16448
RAINES, G. E., Mathematical models of fission-product deposition, 18: 17248 (BMI-X-278)
RAJASEKARAN, G., Scattering amplitudes on unphysical sheets, 18: 16786
RAMACHANDRAN, G. N., Conference on crystallography and crystal perfection, Madras 1/63, 18: 16433
RAMEAU, F., Production of Li-6 and Li-7 fragments in elements, 18: 16977
RAMOS RODRIGUEZ, E., Dosimetry practice in the "Junta de Energia Nuclear," 18: 16268
RAMSDEN, D., High-sensitivity counting techniques, 18: 16354
RANDALL, Charles H., Stochastic models for heterogeneous materials. II., 18: 16647 (KAPL-M-CHR-7)
RANKIN, John S., Jr., Macroscopic benthic fauna off Cape Cod, 18: 17363 (TID-20363)
RANKIN, Mozelle, Formation of neutral atomic H beams, 18: 16703
RANZI, I., Backscatter sounding during ionospheric storms, 18: 16835
RAO, V. Viswesware, Radioactive decay of Cd-115m, 18: 17056
RAPOPORT, I. D., Cosmic radiation beyond atmosphere, 18: 16732 (FTD-TT-64-90(p.163-76))
RAPP, Donald, Ionization of atoms and diatomic molecules by electron impact, 18: 16695

RASMUSSEN, Ronald E., Use of labeled thymidine in cell culture studies, 18: 15802
RAUSA, G., Plasmas formed by reflection of shocks, 18: 17137
RAVETTA, R., Critical heat flux and pressure drop measurements in round vertical tubes, 18: 16172 (EURAEC-951)
RAWER, K., Ionospheric irregularities and movements, 18: 16874
RAY, J. A., Formation of neutral atomic H beams, 18: 16703
RAYKHEL, Rudolf, Scintillation measuring head, 18: 16374
RAYNAL, J., Scattering of deuterons on Ni with tensor potentials, 18: 17041
RAZMI, M. S. K., Single-pion production in π-N collisions, 18: 16779
REDI, O., Spin and nuclear moments of Hg-203, 18: 17066
REES, D. B., Prog. rpt. on direct conversion of nuclear energy, 11/62–10/63, 18: 16740 (AD-425231)
REETZ, Arthur, Neutron and γ heating in Fe slabs, 18: 17243 (GAMD-3690)
Regidor, P. De La Pena
see De La Pena Regidor
REIF, Roland, S-wave-neutron strength function, 18: 16956 (ZFK-TPH-7)
REISSIG, H., Strontium-90 contents of soils and plants, 18: 15909
REMBOLD, E. A., Prog. rpt., 5/63, 18: 16376 (MLM-1157)
REMEZOVA, T. S., Reactivating yeast organisms after radiation injury, 18: 15819 (UCRL-Trans-1029)
REMY, M. L., Rapid determination of I-131 in milk, 18: 15959 (SCPRI(S)-94)
RENNING, Elise L., Carcinoma of the endometrium treated by Ra, 18: 15920
RESINGER, Harold E., Radiation pathology, 18: 15859
REYN, H. W., Heat of sublimation and vapor pressure of Sr, 18: 16517
REYNOLDS, R. C., Subcellular effects of x irradiation, 18: 15864
REYNOLDS, S. A., Radioisotopes in alkaline-earth analysis, 18: 15962 (TID-7689(p.81-5))
RIBON, P., Density functions in Rh-103 for "s" and "p" neutrons, 18: 17032
RICCI, R. A., Scattering of protons on Na-23, Al-27, P-31, K-39, Ti-48, Cr-52, Fe-56, and Co-59, 18: 17071
RICHARDS, J. M., Recording systems for use with solid-state scalers, 18: 16275 (AERE-M-1332)
RICHARDSON, R. M., Disposal of radioactive waste at shallow depth, 18: 17347
RICHMOND, C. R., Cellular elements in peripheral blood of monkeys, 18: 15773 (LAMS-3034(p.96-102))
RICHMOND, C. R., Distribution of Cs-137 in mice and dogs after chronic exposure, 18: 15766 (LAMS-3034(p.41-8))
RICHMOND, C. R., Effect of exercise on excretion of Cs-137, 18: 15765 (LAMS-3034(p.34-40))
RICHMOND, C. R., Effect of temperature on retention of Sr in mice, 18: 15770 (LAMS-3034(p.65-72))
RICHMOND, C. R., Metabolism of Mn-54, 18: 15767 (LAMS-3034(p.49-52))
RICHMOND, C. R., Potassium-40 and Cs-137 levels in beagles, 18: 15771 (LAMS-3034(p.73-5))
RICHMOND, C. R., Retention of intravenously administered Cs-132, 18: 15764 (LAMS-3034(p.21-33))
RICHMOND, C. R., Retention of Zr-95 in mice, 18: 15768 (LAMS-3034 (p.53-8))
RICHMOND, C. R., Retention of intravenously administered Be-7 by rats, 18: 15769 (LAMS-3034(p.59-64))
RICHMOND, C. R., Volume and turnover of body water in monkeys, 18: 15772 (LAMS-3034(p.76-80))
RICHMOND, W. J., Fine-grained U by shot addition during casting, 18: 16454 (NMI-7019)
RIEKE, W. O., Effect of irradiation on long-lived lymphocyte of the rat, 18: 15872
RIGGIN, Charles L., Handling and transportation tests of PM-1, 18: 17299 (MND-M-1915)
RIGNEY, David A., Plating radioactive Zn-65, 18: 16104
RIMONDI, O., Calibration of an absolute spectrometric system, 18: 16358
RINEHART, Robert R., Nitric oxide protection of bacteriophage against x-irradiation damage, 18: 15901
RIOU, M., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
RIOU, M., Inelastic scattering of 155-Mev protons on light nuclei, 18: 17070
RIOU, M., Scattering of protons on Na-23, Al-27, P-31, K-39, Ti-48, Cr-52, Fe-56, and Co-59, 18: 17071
RISSER, J. R., Excitation function of the $N^{14}(p,n)O^{14}$ total cross section, 18: 17061
RISSER, J. R., Investigation of C-12 + He-3 reactions between 1.8 and 5.4 Mev, 18: 17060
RITTENBERG, David, Pathologic anatomy of deuterium intoxication, 18: 15800
RIVET, E., Strongly populated levels of $(d_{5/2})^{\frac{1}{2}}$ and $(f_{7/2})^{\frac{1}{2}}$ configuration in (α,d) reaction, 18: 16933 (ANL-6848(p.182-7))
RIVIERE, A. C., Ionization of excited H atoms by strong electric fields, 18: 16709
ROBAYE, G., Angular distribution in reaction $Li^6(n,t)He^4$, 18: 16965
ROBERSON, N. R., Selection rules in $Ti^{48}(p,p')$ inelastic scattering, 18: 16930 (ANL-6848(p.168-71))
ROBERT, Emilien, Basic measurements in a rail-type plasma gun, 18: 17131
ROBERTS, F., Fine-grained graphites for nuclear applications, 18: 16465 (AERE-R-3943)
ROBERTS, I. C., Program of ground disposal R and D, 18: 17339
ROBERTSON, James S., Dose distribution in animals subjected to whole-body irradiation, 18: 15753
ROBERTSON, W. W., Helium metastable admixed gas reactions, 18: 16719
ROBINSON, C. J., Measurement of G-I absorption of Co^{58}-labeled vitamin B_{12}, 18: 15799
ROBINSON, J. E., Diffusive motions of Fe-57 ions in glycerine, 18: 16044
ROBINSON, James Alan, Beryllium alloys, 18: 16448
ROCHE, Roland, Devices for anchoring and extracting plugs in fuel channel, 18: 17272
ROCHE, Roland, Improvements in reactors, 18: 17268
ROCHESTER, G. K., Spins and moments of Ag-108 and Cu-66, 18: 17068
ROE, B. P., Determination of spin of f^0 resonance, 18: 16792
ROERSCH, A., Dark reactivation of uv-irradiated bacteriophage DNA, 18: 15832
ROGACHEV, I. M., β_0 component in Pb-210 decay, 18: 17094
ROGACHEVA, S. A., Peculiarities in course and outcome of radiation sickness in dogs injected intravenously with nitrate of Pu-239, 18: 15817 (FTD-TT-63-559(p.150-72))
ROGEL'BERG, I. L., Influence of plastic deformation and heat treatment on Be bronze, 18: 16497
ROGERS, A. W., Autoradiography of H-3 on chromatograms, 18: 15984
ROGERS, John L., Superconductive device, 18: 16290
ROINISHVILI, N. N., Track spark chamber, 18: 16327
ROITT, I. M., Effects of steroid sex hormones on immunological phenomena, 18: 15752
ROLF, Howard L., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
ROLLAND, C., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
ROLLINSON, E., Pulse radiolysis using constricted air spark light source, 18: 16101
ROMANOV, A. M., Radioactive transmutation of nuclei and atomic shells, 18: 17096
ROMANOVA, L. M., Milne problem for semi-infinite medium, 18: 16900
RONEY, Paul L., System to obtain data on population exposure to x rays, 18: 16248
RONNE, B., Kinematical analysis of bubble chamber pictures, 18: 16296 (CERN-64-13(Vol.I)(p.87-129))
ROOKSBY, H. P., Structural features of C and graphite, 18: 16491
ROOT, John W., Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
ROPER, L. David, Evidence for P_{11} π-N resonance at 556 Mev, 18: 16791
ROSE, G., Disturbances of pulse radio transmission, 18: 16840
ROSE, H., Joint AN/CNEN/NPPC irradiation program, 18: 17328
ROSE, Raymond G., Use of P-32 to detect neoplasia of G-I tract, 18: 15929
ROSEN, Seymour, Observations in radiation nephritis, 18: 15862
ROSENBERG, Albert, Emission of neutrons on rupture of U nucleus, 18: 16957 (AEC-tr-6371)
ROSENBLUM, Charles, Residue studies with radioisotopic drugs, 18: 15784 (TID-7689(p.58-62))

ROSENKRANZ, H., Coolant and circulating pumps in PWR's, 18: 17267
ROSS, D. M., External radiation dosimetry practices in U. S., 18: 16265
ROSS, H. H., Alpha gage system for measurement of gas density, gas pressure, and thin film thickness, 18: 16383 (TID-7688(p.7-13))
ROSS, H. H., Scintillator for neutron detector, 18: 16803 (TID-7689(p.103-5))
ROSS, Harley H., Scintillation counting of I-129 and I-125, 18: 15961 (TID-7688(p.20-1))
ROSS, W. J., Distribution of ionization about the magnetic equator, 18: 16853
ROSSI, P., Thyroid capture of I-131 in the rat, 18: 15789
ROSTAS, J., Inelastic collisions between electrons and some molecules, 18: 16700
ROSTOKER, Norman, Superposition of dressed test particles, 18: 17163
ROSTOKER, Norman, Test particle method in kinetic theory of plasma, 18: 17164
ROSWIT, Bernard, Dose distribution in animals subjected to whole-body x irradiation, 18: 15753
ROTH, J. Reece, Nonadiabatic motion of charged particle, 18: 17169
ROTH, L. J., Use of S^{35}-acetazolamide in blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))
ROTHENSTEIN, W., Boundary conditions in gap geometry, 18: 17256
ROTHWELL, P., Diffusion of ions between F layers, 18: 16870
ROTONDI, E., Measurement of fast neutron flux by means of a non-directional counter, 18: 16362
ROTT, Nicholas, Inversion of Boltzmann equation, 18: 16419
ROTURIER, J., Scattering of 14-Mev neutrons by C-12: excited states, 18: 16968
ROUSSEL, P., Angular correlations in (d,p) stripping reactions on Be-9 and Ca-40, 18: 16993
ROUSSET, A., Pion-nucleon cross section, 18: 16776
ROWE, Joseph H., Characteristics of two-stage repetitively fired coaxial gun, 18: 17140
ROWE, M. W., Effect of ashing temperature on Cs and K content of bone, 18: 15953 (LAMS-3034(p.201-4))
ROWE, P. N., Gas-solid reaction in fluidized bed, 18: 16135
ROWLAND, F. S., Investigation of isotopic exchange reactions using S-35, 18: 15999 (TID-7689(p.93-5))
ROWLAND, F. S., Recycle gas chromatography: separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
ROWLANDS, J. R., Radiation damage in some aliphatic acids and salts, 18: 16091
ROWLEY, D. B., Radiosensitivity of dehydrogenases and transaminases, 18: 15845
ROYO, J., Properties of rubber types, 18: 17371 (SC-T-64-45)
ROZENFEL'D, I. L., Inhibiting properties of pertechnetate ion, 18: 16443 (ORNL-tr-32)
RUBIN, Eliezer, Prog. rpt. on removal of metallic ions by foaming agents, 7/62–6/63, 18: 16129 (RAI-116)
RUBIN, K., Prog. rpt. on low-density plasmas, annual, 18: 17121 (TID-20362)
RUBY, S. L., Stimulated emission of γ radiation, 18: 16952 (TID-20313)
RUCKWIED, Armin, Strengthening of neutron-irradiated single crystals of Cu. I., 18: 16530 (AEC-tr-6373)
RUDAKOV, V. P., Magnetic β spectrograph with wide focus, 18: 16332
RUDGE, M. R. H., Detachment from the negative H ion, 18: 16683
RUEPPEL, Walter B., Afterglow tails and stability of high-density nanosecond arc channels, 18: 17235
RUHLA, C., Inelastic scattering of 155-Mev protons on light nuclei, 18: 17070
RUHLA, C., Scattering of protons on Na-23, Al-27, P-31, K-39, Ti-48, Cr-52, Fe-56, and Co-59, 18: 17071
RUHLA, Ch., Inelastic scattering of protons on Si-28, S-32, and Ca-40, 18: 17042
RUMI, B., Implosion phase of theta pinch, 18: 17119 (RT/FI(63)-48)
RUMP. B., Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)
RUSSELL, C. R., Deuterium-filled thyratron, 18: 16167
RUSSELL, E. S., Electronic measurement of cellular volumes. VIII., 18: 15743 (LAMS-3034(p.279-85))
RUSSELL, J. A., Electric, magnetic, and seismo-electric signals from nuclear explosions, 18: 16546 (AWRE-O-87/63)
RUSSELL, Jerome A. G., Precision flying-spot film digitizer, 18: 16414 (UCRL-7619)
RUSSELL, R. Scott, Movement of Sr and Cs in soils, 18: 16239
RUSSELL, R. Scott, Ratios of Sr-90 to Ca in milk and in bones of infants, 18: 15796
RUTHER, W. E., Corrosion of Al powder products, 18: 16438 (ANL-6785)
RUTKEVICH, B. N., High-frequency oscillations of plasma in magnetic fields, 18: 17109 (NP-13612)
RUTOWSKI, R. W., Shock tube studies of radiative transport in an Ar plasma, 17: 17173
RYNN, N., Transport properties of fully ionized low-temperature plasma, 18: 17223
RYSHKEWITCH, Eugene, Low-density thermal insulation materials, 18: 16520
RYSHKEWITCH, Eugene I., Producing monocrystalline beryllia fibers and platelets, 18: 16435
RYZHOV, N. M., Plasma injection into magnetic trap, 18: 17110 (NP-13623)

S

SABIN, C. M., Prog. rpt. on high acceleration field heat transfer for SNAP, 9–11/63, 18: 16177 (TID-20133)
SABIN, C. M., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
SACHDEVA, B. K., Electron oscillations in bounded plasma, 18: 17180
SACTON, J., Experimental results in physics of hyperfragments, 18: 16963
SADEGHI, A., Determination of neutron cross sections, 18: 16970
SADEGHI, A., Excited levels of Na-23 following α reactions on F-19, 18: 17001
SADEGHI, A., Reactions (d,p) and (d,d) on C-12, 18: 16991
SADEIGHI, A., Angular distribution and cross section for $Li^6(p,He^3)He^4$, 18: 17029
SAENGER, Eugene L., Radiation exposure from radioiodine, 18: 15939
SAETTA-MENICHELLA, E., Statistical model analysis of (n,α) reactions. I., 18: 17057
SAETTA-MENICHELLA, E., Statistical model analysis of (n,α) reactions. II., 18: 17058
SAHA, N. N., Synthesis, storage and manipulation of tritiated steroid estrogens, 18: 16078 (TID-7689(p.46-50))
SALA, Jose M., Healing of wounds within irradiated tissue, 18: 15942
SALABE, G. B., Thyroid capture of I-131 in the rat, 18: 15789
SALAMANCA DE LA PENA, F., Iodine-131 and the Freedman reaction, 18: 15821
SALMON, J., Theory of mobility of ions and electrons, 18: 17219
SALOMON, Mark, Isotope effects in methyl radical abstraction reactions, 18: 16071
SAMIOS, N. P., Weak-interaction experiments with 1000-Bev accelerator, 18: 16750 (BNL-7534(p.88-106))
SAMPSON, W. B., Brookhaven coil construction program, 18: 16603 (BNL-7534(p.448))
SAMSON, G., Measurement of fast neutron flux, 18: 16356
SAMSONOV, G. V., Reduction of La and Ce oxides by Al, 18: 16430
SAMUEL, Aryeh H., Radiation-induced chlorination of toluene by stannic chloride, 18: 16094
SANDERS, J. B., Range of focused collision sequences in Cu, 18: 16672
SANDERS, P. C., Establishment of karyographic methods as tool in radiopathology, 18: 15738 (LAMS-3034(p.227-34))
SANDERSON, J. V., Effect of radionuclide fractionation on exposure dose rate from local fallout, 18: 16234 (USNRDL-TR-715)
SANDS, F. L., Effect of uv radiation on chlorpromazine. I., 18: 16092
SANFORD, P. W., Rocket measurements of the sun's x-ray tail, 18: 16640
SANGAL, Satendra P., Metal chelates of rare earths. I., 18: 16039
SANTONI, A., Decay of W-176, 18: 16983
SARETT, Herbert P., Nutritional quality of survival biscuits and crackers, 18: 16237
SARGENT, H. B., Characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
SARLITTO, R. J., Characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
SASTRY, B. V. Rama, Biological behavior of Cs-137, 18: 15783 (TID-7689 (p.55-8))

SATCHLER, G. R., Nucleon capture reactions near A = 40, 18: 16931 (ANL-6848(p.177))
SATO, T., Charged particles in upper atmosphere and relations to geomagnetic storms, 18: 16734
SAUDINOS, J., Inelastic scattering of 44-Mev α particles in medium-weight nuclei, 18: 16925 (ANL-6848(p.137-42))
SAULITE, U., Scintillation β spectrometer, 18: 16347
SAUNIER, N., Coincidences due to reactions of Li-6 on Li-6 and Be-9, 18: 17005
SAUNIER, N., Nuclear reactions produced by Li-6 ions at 5 Mev, 18: 17007
SAVENKO, I. A., Cosmic radiation beyond atmosphere, 18: 16732 (FTD-TT-64-90(p.163-76))
SAVERY, C. W., Jr., Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)
SAVINTSEV, P. A., Effect of radiation on contact melting of metals, 18: 16538
SAVITSKII, E. M., Investigation of Nb–W–Zr and Nb–Mo–Zr, 18: 16494
SAWERS, J. R., Neutron polarization and cross sections for $C^{13}(d,n)N^{14}$ reaction, 18: 16908 (ANL-6848(p.16-23))
SAYA, F., Simple model of stripping reaction on Be-9 and N-14, 18: 17053
SAYERS, J., Electron density profile above the F2 region, 18: 16877
SCHAEFER, H., Electrolytical Fe-55 source production, 18: 16404
SCHALLHORN, Dale R., Radiation-induced cable currents. I., 18: 16522 (AD-429954)
SCHARMANN, A., Measurement of external radiation doses, 18: 16260
SCHECTER, L., Polarized deuterons of Saclay cyclotron, 18: 16617
SCHEIBE, H., Uranium dioxide oxidation, 18: 16037
SCHEIBE, Horst, Production of sintered UO_2, 18: 16463
SCHEIBLING, F., Double γ emission in monopolar transitions, 18: 16999
SCHEIBLING, F., Electromagnetic transition probabilities in O-16, 18: 16998
SCHENCK, Guenther O., Radiation chemical thermal decomposition of hydrocarbons, 18: 16116
SCHERF, H., D-Tryptophan in higher plants, 18: 17366 (AEC-tr-6363)
SCHERLE, W., Electrodeposition of ThO_2 on Al, 18: 16460
SCHIAU, S., Changes in immunity due to ionizing rays, 18: 15881
SCHIFFER, J. P., Reactions (d,n) on Fe-54 and Ni-58, 18: 16917 (ANL-6848(p.98-103))
SCHILLING, Werner, Relaxation phenomena in cold-worked Cu, 18: 16484 (AI-Trans-34)
SCHILLING, Werner, Saturation phenomena of defect production by irradiation at low temperature, 18: 16531 (AI-Trans-38)
SCHINTLMEISTER, J., Decay of Ag-110m, 18: 17051
SCHLEIN, P. E., Isotopic spin of the η meson, 18: 16783
SCHLOTT, Karl, Energy and energy distribution of cyclotron rays, 18: 16611 (ZFK-PHA-5)
SCHLUETER, A., Microfield of plasma and influence on ionization, 18: 17205
SCHLUETER, J., Influence of impurities on high-density D plasma, 18: 17179
SCHMALZ, Bruce L., Migration of isotopes at NRTS, 18: 17349
SCHMALZRIED, Hermann, Ion and electron conduction in binary oxides, 18: 17370 (SC-T-64-44)
SCHMEISER, Kurt, Radionuclides, 18: 16380
SCHMID, L. C., PRCF experiments with H_2O moderator, 18: 17298 (HW-80092)
SCHMIDT, F. H., Graphs for determination of plume rise, 18: 16235 (AEC-tr-6365)
SCHMIDT, Hans-Ludwig, Synthetic incorporation of C-14 into tropine, (±) tropic acid, and atropine, 18: 16069
SCHMIDT-ROHR, U., Deuteron-γ angular correlation in $Mg^{24}(d,d'\gamma)$, 18: 16922 (ANL-6848(p.123-4))
SCHMOUKER, Jean, Reaction $C^{13}(He^3,\alpha)C^{12}$ between 1 and 2 Mev, 18: 16948 (NP-13732)
SCHNEIDER, R. W., Prestressing two-layer pressure vessel, 18: 17260 (ORNL-3546(Suppl.1))
SCHNEIDER, Samuel J., Melting points of metal oxides, 18: 15996 (NBS-MON-68)
SCHNEIDER, U., Neutron measurements on paraffin pile, 18: 16892 (JUL-140-RX)
SCHNEIDER, W., Knight shift in Be, 18: 16515
SCHNEIDER, W. A., Ocean-bottom seismic measurements off California coast, 18: 16198
SCHOCH, A., Studies on proton storage rings, 18: 16585 (BNL-7534(p.128-70))
SCHOENDORF, William H., Propagation of wave through a diffusing plasma, 18: 17129
SCHOLTE, P. J. L., Sex ratio shifts among progeny from patients having received x radiation, 18: 15823
SCHONFELD, Ernest, Prog. rpt. on removal of metallic ions by foaming agents, 7/62–6/63, 18: 16129 (RAI-116)
SCHRAM, Pieter, Correlation function in plasma outside equilibrium, 18: 17198
SCHRAM, Pieter, Kinetic equation for plasma in magnetic field, 18: 17199
SCHREIBER, Bruno, Prog. rpt. on radioactivity in marine environment, 1963, 18: 15758 (TID-20347)
SCHREIBER, Bruno, Prog. rpt. on ecology of acantharia in relation to Sr in sea, 18: 15759 (TID-20366)
SCHRODER, I. G., Ternary fission of U-235 by slow neutrons, 18: 17003
SCHUEMMELFEDER, Norbert, Radiation necrosis of the cerebellum, 18: 15830
SCHULMAN, J. H., Thermoluminescence methods in personnel dosimetry, 18: 16361
SCHULTE, K. E., Detection of radioisotopes in urine. I., 18: 15987
SCHULTE, K. E., Detection of radioisotopes in urine. II., 18: 15988
SCHULTE, K. E., Detection of radioisotopes in urine. III., 18: 15989
SCHULTZ, Floyd V., Propagation of wave through a diffusing plasma, 18: 17129
SCHULZ, G. J., Vibrational excitation of N_2 by electron impact, 18: 16699
SCHULZE, G. E. R., Neutron diffraction of ideal crystals, 18: 16510
SCHUSTER, C. L., Airborne vibration analysis system, 18: 16280 (SC-TM-328-62(72))
SCHWARTZ, M., Possible high-intensity, high-energy accelerator, 18: 16597 (BNL-7534(p.385-91))
SCHWEITZER, W. F., Inability of mouse to recognize γ radiations. I., 18: 15811 (LAMS-3034(p.133-40))
SCHWENZFEIER, C. W., Air sampling of Be production facilities, 18: 16236
SCHWOCHAU, K., Chemistry of Tc, 18: 15947
SCOTT, F. Robert, Plasma injection and trapping measurements, 18: 17128
SCOTT, H. D., Analysis of $Cr^{53}(d,p)Cr^{53}$ reaction, 18: 16913 (ANL-6848 (p.63-9))
SCROGGS, R. J., Multicrystal γ spectrometer, 18: 16315
SCULLMAN, R., Spectra of PdH and PdD, 18: 16575
SEABORN, G. B., Fixed filter paper α air monitor, 18: 16298 (K-1589)
SEAMAN, F. D., Prog. rpt. on welding refractory metals, 10–12/63, 18: 16450 (AD-431672)
SEARL, Milton F., Nuclear power and system characteristics, 18: 17305
SEASE, J. D., Thorium–uranium-233 oxide facility, 18: 16455 (ORNL-3539)
SEATON, M. F., Excitation of coronal lines by proton impact, 18: 16635
SEATON, M. F., Recombination spectra. II., 18: 16632
SEATON, M. F., Recombination spectra. III., 18: 16633
SEBEK, Z., Probes for adjusting the cyclotron beam, 18: 16618
SEDLACEK, Z., Equations of motion of particle in circular accelerator, 18: 16612
SEDLAKOVA, L., Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)
SEGAERT, O., Lifetime of 2083-kev level in Ce-140, 18: 16990
SEGAERT, O., Lifetime of first excited state in Dy-160, 18: 17085
SEKI, M., Fission of Th-232 induced by He ions, 18: 17067
SELIG, Henry, Xenon tetroxide: preparation and properties, 18: 16052
SELLEN, J. M., Jr., Ion beam neutral component determinations, 18: 16581
SELLERS, F. B., Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
SELTZER, Ronald A., Radiation exposure from radioiodine, 18: 15939
SELTZER, Stanley, Transition state in methyl radical formation, 18: 16086
SELTZER, Stephen M., Electrons transmitted through Al_2O_3 foils, 18: 17244 (NASA-SP-3008)
SEMAN, D. J., Prog. rpt. on welding refractory metals, 10–12/63, 18: 16450 (AD-431672)
SEN, D. K., Theoretical basis for two neutrinos, 18: 16782
SENE, R., Construction of generator of 14-Mev polarized neutrons, 18: 16902
SENKIN, Joan E., Bibliography on refractory metal borides and nitrides,

18: 16481 (UCRL-7559)
SERGEEV, V. O., Decay scheme of radioactive nuclei A ≥ 100, 18: 17099
SERRINI, G., Determination of Al in SAP, 18: 15949 (EUR-585.i)
SETTER, Lloyd R., Measurements of gross β radioactivity in H_2O, 18: 15979
SETTI, R. Levi, Cosmic ray results at ultra-high energies, 18: 16728 (BNL-7534(p.2-28))
SGOUTAS, Demetrios S., Chemical synthesis of H^3-labeled linoleic acid, 18: 16070
SHAFRANOVA, M. G., $(CH_3)n$ thin films as synchrocyclotron targets, 18: 16794
SHAFROTH, S., Gamma rays from reaction of Li-6 on Li-6, 18: 17006
SHALNIKOV, A. I., Production of thin Ti–D and Ti–T targets, 18: 16461
SHANKAR, Jagdish, Analysis of H-bonded crystals, 18: 16055
SHANKS, H. R., Thermal study of the W bronzes, 18: 16030
SHARKHATUNYAN, R. O., Polarization of cosmic muons and determination of ratio $K^+/K^- + \pi^+$, 18: 16762 (NP-13694)
SHARPE, Jack, Radioactivity contamination monitor, 18: 16372
SHARPE, R. S., Examination of coated nuclear fuel particles, 18: 17291
SHATUNOV, V. M., Gas-discharge pulse apparatus for testing plasma diagnostic equipment, 18: 17114 (NP-13705)
SHAW, Gordon L., Approximate solution to the N/D equations, 18: 16813
SHAW, P. F. D., Szilard-Chalmers effect in cyclohexane–iodide mixtures, 18: 16112
SHCHERBOVA, E. N., CNS changes in experimental radiation sickness, 18: 15836
SHEALY, C. Norman, Gallium-68 as a scanning agent, 18: 15931
SHEELIN, V. N., Charged-particle diffusion in magnetic field, 18: 17227
SHEETS, Allen R., Producing monocrystalline beryllia fibers and platelets, 18: 16435
SHEIKO, I. N., Fusibility diagram for NaF–KF–ZrF_4 system, 18: 16008 (ORNL-tr-31)
SHEN, Benjamin C., Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
SHENDEROVICH, A. M., Errors due to dead time of counters with background present, 18: 16349
SHEPHERD, G. R., Nucleic acids: automated base analysis, 18: 15954 (LAMS-3034(p.313-18))
SHEPHERD, G. R., Ultracentrifugal sedimentation-velocity molecular weight data for DNA, 18: 15778 (LAMS-3034(p.319-25))
SHERMAN, Martin P., Radiation probe for arcjet measurements, 18: 17138
SHEVCHUCK, Sergey, Generation of transverse waves by directed explosions, 18: 17372 (UCRL-Trans-992(L))
SHIBATA, Nagao, Production of P-32, S-35, and I-131, 18: 16398 (JAERI-4027)
SHIKATA, Eiji, Production of P-32, S-35, and I-131, 18: 16398 (JAERI-4027)
SHIM, S. C., Ion absorption by banana leaf disks, 18: 15798
SHIMAMOTO, Y., Lee model with four-point coupling, 18: 16778
SHIRCHENKO, V. S., Apparatus for measurements of magnetic field in a-c accelerators, 18: 16626
SHLYAPNIKOV, R. S., Equipment for processing bubble chamber photographs, 18: 16336
SHONE, Michael G. T., Movement of Sr and Cs in soils, 18: 16239
SHREIR, L. L., Electrochemistry of Nb in fused halides, 18: 16032
SHUBERT, F. L., Corrosion and H absorption of Zy-2, 18: 16440 (WAPD-283)
SHULER, Kurt E., Preservation of canonical distribution in Markovian relaxation processes, 18: 16417
SHUMWAY, Robert H., Radionuclide analysis of γ spectra, 18: 16353
SHVACHUNOV, I. N., Motion of charged particles in magnetic dipole field, 18: 16554 (FTD-TT-64-90(p.128-62))
SIBILLE, G., Emission of internal pairs by 3.63-Mev level in O-18, 18: 17000
SIDOROV, A. N., H → D exchange between chlorophyll-type pigments and D-containing compounds, 18: 16042
SIEGERT, Arnold J. F., Field operators for bosons with impenetrable cores. II., 18: 16804
SIEVERT, Rolf M., Method of recording individual doses, 18: 16261
SILIN, V. P., Rate of equalization of plasma temperatures, 18: 17152
SILVERMAN, Leslie, Foam suppression of radioactive iodine and particulates, 18: 16128 (NYO-9324)
SILVESTRI, M., Heat transfer to steam–H_2O mixtures, 18: 16171 (EURAEC-929)
SIMON, Norman, Low-dose fluororadiography, 18: 15936
SIMONOFF, G., De-excitation of Dy obtained by proton bombardment of Tb, 18: 16975
SIMPSON, J. Arol, Ionization limit in inelastic electron scattering in the rare gases, 18: 16697
SIMPSON, O. D., Doppler broadening of total neutron cross sections of Pu-241, 18: 16942 (IDO-16954)
SINCLAIR, Daniel, Determination of spin of f^0 resonance, 18: 16792
SINEL'NIKOV, K. D., Filling of magnetic trap GVL-2 with plasma, 18: 17108 (NP-13609)
SINEL'NIKOV, K. D., Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)
SINGH, M. P., Hydromagnetics of spherical conductor, 18: 16547 (AD-416626)
SINGWI, K. S., Diffusive motions of Fe-57 ions in glycerine, 18: 16044
SINHA, Surendra N., Metal chelates of rare earths. I., 18: 16039
SINITSA, N. G., Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)
SIPPEL, D., Neutron diffraction of ideal crystals, 18: 16510
SIRONI, Giuseppe, Determination of trace metals in petroleum, 18: 15968
SISCOE, G. L., Aerodynamic aspects of magnetospheric flow, 18: 16629 (AD-430410)
SIX, Jules, Lepton decays of Λ^0 and Σ^-, 18: 16764 (NP-13731)
SJOEGREN, Hogen, Ionization efficiency curves for positive and negative ions, 18: 16701
SJOESTRAND, Bernt, Determination of Hg and As in organic materials, 18: 15971
SJOSTRAND, U., Recording of rapidly changing radioactive counting rates, 18: 16311
SKIBENKO, E. I., Optimum parameters of GVL-2 magnetic system, 18: 17116 (NP-13711)
SKIFSTAD, J. G., Analysis of arc-heating phenomena in tube, 18: 17132
SKJEGGESTAD, O., Notes on phase space, 18: 16755 (CERN-64-13 (Vol.II)(p.1-73))
SKLAROFF, David M., Photoscanning with Sr-85, 18: 15932
SKLYAR, N. T., Angular distributions of 0.3-Mev neutrons elastically scattered, 18: 17090
SKLYAR, N. T., Elastic scattering of 0.65-Mev neutrons, 18: 17089
SKOBLIK, I. P., Plasma injection into magnetic trap, 18: 17110 (NP-13623)
SKREB, N., Does N mustard mimic x-ray effects? 18: 15834
SKURIDIN, G. A., Invariants of motion of charged particle in stationary heterogeneous magnetic field, 18: 16553 (FTD-TT-64-90(p.80-109))
SKURIDIN, G. A., Motion of charged particles in magnetic dipole field, 18: 16554 (FTD-TT-64-90(p.128-62))
SLAVIN, Walter, Atomic absorption spectrophotometer, 18: 16281
SMALES, A. A., Determination of Rb and Cs in stony meteorites, 18: 15976
SMIRENKIN, G. N., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
SMIRNOV, A. I., Spectrometer for investigating spin-lattice relaxation spectra, 18: 16342
SMIRNOVA, M. N., Spectral determination of small quantities of Hf and Th in natural materials, 18: 15991
SMITH, A. B., Reactions (d,n) on Fe-54 and Ni-58, 18: 16917 (ANL-6848 (p.98-103))
SMITH, F. J., Ion-molecule rearrangement collisions, 18: 16676
SMITH, J. C., Response of insect eye to β radiation, 18: 15814 (USNRDL-TR-698)
SMITH, K., Excitation of He^+ by electrons, 18: 16681
SMITH, K. F., Spins and moments of Ag-108 and Cu-66, 18: 17068
SMITH, L. B., Determination of Fermi surfaces in graphite, 18: 16514
SMITH, M. G., Isotropic scattering of concentrated ray pencil from point source, 18: 16796
SMITH, P. B., Reaction $Si^{30}(p,\gamma)P^{31}$ between 1 and 1.53 Mev, 18: 17080
SMITH, T. M., Simulation of thin plasma sheath, 18: 17139
SMITH, William R., Analysis of $Zr^{96}(d,p)\ Zr^{97}$ stripping reaction, 18: 16909 (ANL-6848(p.30-7))
SMOLUCHOWSKI, R., Annealing of the x-ray-induced volume expansion and coloration of LiF, 18: 16107
SMOLUCHOWSKI, R., Color center behavior of NaCl irradiated at low

temperature, 18: 16106
SMYRL, W. H., Extraction of lanthanons from electrolytes with Li amalgam, 18: 15945 (LADC-6084)
SNOEK, C., Sputtering of Cu by 20-kev noble gas ions, 18: 16673
SNOEK, Cornelis, Single-collision scattering of Ar ions from metals, 18: 16667
SNYDER, W. S., Estimates of $(MPC)_w$ for Sr-90, Sr-89, and Sr-85, 18: 15907
SNYDER, W. S., Hazard of radioactive materials, 18: 16241
SOBELS, F. H., Sex ratio shifts among progeny from patients having received x radiation, 18: 15823
SOEDING, P., Proton-proton and proton-antiproton forward scattering amplitude, 18: 16787
SOKOLOVA, I. M., Influence of plastic deformation and heat treatment on Be bronze, 18: 16497
SOLLICH, W. A., π-Complexes in catalytic tritiation, 18: 16040
SOLOMON, Leonard H., Observation of a solar-type radio burst from flare star, 18: 16638
SONA, P. G., Cross section for production of H atoms in the 2S state, 18: 16704
SONODA, M., Fission of Th-232 induced by He ions, 18: 17067
SORENSON, G. D., Effects of x radiation on spleen in rat, 18: 15863
SOTONA, M., Excitation of nuclear rotational levels, 18: 16959
SOUCHERE, G., Inelastic scattering of 14.1-Mev neutrons by S-32, 18: 16972
SOUDAIN, G., Experience and practice with film dosimetry, 18: 16257
SOULE, D. E., Determination of Fermi surfaces in graphite, 18: 16514
SOULIOTIS, Anthony G., Determination of S and P in paper and beer, 18: 15970
SOVIE, Ronald J., Percentage ionization in a He plasma, 18: 17177
SPALDING, E. F., Radiation-induced irreparable biological damage in mice, 18: 15810 (LAMS-3034(p.129-32))
SPALDING, J. F., Acute radiosensitivity as function of age in mice, 18: 15807 (LAMS-3034(p.112-15))
SPALDING, J. F., Aging in mice with different histories of ancestral x-ray exposure, 18: 15808 (LAMS-3034(p.116-23))
SPALDING, J. F., Breeding characteristics of offspring from mice with fifteen generations of x irradiation, 18: 15809 (LAMS-3034(p.124-8))
SPALDING, J. F., Chromosome observations in nonirradiated progeny from irradiated RF males, 18: 15812 (LAMS-3034(p.303-6))
SPALDING, J. F., Inability of mouse to recognize γ radiations. I., 18: 15811 (LAMS-3034(p.133-40))
SPANGENBERG, Harry D., Jr., Potentials of isotopic radiography, 18: 15918 (TID-7689(p.29-30))
SPERDUTO, A., Titanium-48 levels from (d,p) reaction, 18: 16915 (ANL-6848(p.79-85))
SPERNOL, A., Absolute gas counting of tritium. I., 18: 15978
SPINCER, D., Quantitative inorganic chromatography. XI., 18: 16142
SPINELLI, F., Construction of nuclear-propelled merchant ships, 18: 17321 (RTI/ING(63)-5)
SPIRIN, G. S., Luminescence of irradiated crystalline quartz, 18: 16120
SPITSYN, V. I., Inhibiting properties of pertechnetate ion, 18: 16443 (ORNL-tr-32)
SPITZ, J., Dosage of H_2O_2 using uv spectrophotometry, 18: 15948 (CEA-2391)
SPONGBERG, Richard M., Gasdynamic instrumentation of high-enthalpy flows, 18: 17145
SPRATT, John S., Jr., Healing of wounds within irradiated tissue, 18: 15942
SPREADBOROUGH, J., Etch-pit observations concerning twins in Fe and Fe alloys, 18: 16471 (EURAEC-978)
STABLER, Robert C., Three-body electron-ion recombination rate, 18: 16726
STAHL, D., Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)
STAMM, H., Ureter and bladder fistulas after surgery and irradiation for uterine carcinoma, 18: 15839
STANER, P., Movement of radioelements in soil, 18: 17341
STANNERS, Walter Forrester, Improvements in or relating to reactors, 18: 17270
STARODUBTSEV, S. V., Effects of h-f discharge on adsorption properties of silica gels and zeolites, 18: 16117
STARODUBTSEV, S. V., Effects of γ radiation on adsorptive properties of synthetic zeolites, 18: 16118
STARODUBTSEV, S. V., Effects of γ radiation on dielectric properties of triglycine sulfate crystals, 18: 16124
STARODUBTSEV, S. V., Effects of radiation on Se crystallization, 18: 16540
STARODUBTSEV, S. V., Effects of intrinsic field shift in irradiated seignetto salt crystals, 18: 16545
STARODUBTSEV, S. V., Luminescence of irradiated crystalline quartz, 18: 16120
STARODUBTSEV, S. V., Radioactive transmutation of nuclei and atomic shells, 18: 17096
STAUFFER, A. D., Ionization of excited states of H by electron impact, 18: 16691
STEELE, E. L., Prog. rpt. on determination of O in K, 12/63, 18: 15951 (GA-4855)
STEELE, L. E., Prog. rpt. on irradiation effects on structural materials, 11/62–1/63, 18: 16527 (NRL-Memo-1393)
STEIDL, David V., Fluid-bed fluoride volatility processes. V., 18: 16076 (ANL-6812)
STEINDLER, Martin J., Fluid-bed fluoride volatility processes. V., 18: 16076 (ANL-6812)
STEPANENKO, I. A., Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)
STEPANOV, K. N., Cherenkov absorption of "whistles" in plasma cylinde, 18: 17153
STEPANOV, L. N., Cherenkov damping of h-f plasma oscillations, 18: 17154
STEPHAN, C., Fission of U, Bi, and Au, induced by 156-Mev protons, 18: 17004
STERN, R. A., Drift velocity of electrons in He at high E/P, 18: 17220
STIENS, R. R., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
STINE, Howard A., Axial flow through wall-constricted d-c arc, 18: 17133
STODIEK, W., Particle losses of Cs plasma in stellarator, 18: 17228
STOENESCU, R., Changes in immunity due to ionizing rays, 18: 15881
STOKES, R. H., Electrostatic self energies of gaseous ions, 18: 16017
STOKES, R. H., Van der Waals radii of gaseous ions of noble gas structure, 18: 16016
STOKES, R. J., Mechanical behavior of MgO, 18: 16472 (HR-64-253)
STOKES, R. J., Notch impact behavior of W, 18: 16475 (NP-13755)
STONE, J. A., Radiation chemistry of cyclohexane. VI., 18: 16082
STONE, Wilson S., Nitric oxide protection of bacteriophage against x-irradiation damage, 18: 15901
STONER, Richard D., Enhanced antitoxin responses in irradiated mice, 18: 15856
STORK, D. H., Isotopic spin of the η meson, 18: 16783
STRAND, T. G., Scattering factors for x rays and electrons, 18: 16656
STRASSER, A., Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)
STRATTON, J. R., Sterilization of barley malt with γ radiation, 18: 15841
STRAUB, Rita F., Effects of heavy high-energy charged particles. III., 18: 15828
STRICKLER, D. W., Ionic conductivity of $CaO–Y_2O_3–ZrO_2$, 18: 16014
STROKE, H. H., Spin and nuclear moments of Hg-203, 18: 17066
STRUNOV, L. N., $(CH_2)n$ thin films as synchrocyclotron targets, 18: 16794
STRZALKOWSKI, A., Scattering of deuterons on Si-28 and excitation of core of Al-27, 18: 17021
STUART, Michael, Production of C masses, 18: 16464
STUBBE, P., Temperature variation in F region during last sunspot cycle, 18: 16851
STYHR, Karsten H., Low-density thermal insulation materials, 18: 16520
SUBBOTIN, V. I., Heat transfer in liquid metals flowing through pipes, 18: 16173 (NP-13656)
SUBBOTIN, V. I., Heat exchange in transverse flow around tube bundles, 18: 16175 (NP-13712)
SUCHER, J., Relativistic particle dynamics and the S matrix, 18: 16769
SUETIN, V. A., Equipment for processing bubble chamber photographs, 18: 16336
SUGAHARA, T., Radiosensitivity and SH compounds in mammalian cells, 18: 15897
SUGAWARA, H., Nonleptonic decay of hyperons, 18: 16780
SULLIVAN, E., Electron impact ionization of H, 18: 16693
SUMMERS, Robert L., Effects of Cs vapor on ionization gages, 18: 16277

(NASA-TN-D-2264)
SUMMERS, Roy E., Radiation effect on the kidney, 18: 15880
SUNDERMAN, D. N., Filter efficiency in removal of oil mist from compressed air, 18: 16388 (TID-7688(p.78-80))
SURAZHSKII, D. Ya., Problems in applied radiogeology, 18: 16222
SURGET, G., Total cross section of Ni for neutrons of 175 to 300 kev, 18: 17038
SUTTER, G., Double γ emission in monopolar transitions, 18: 16999
SUTTLE, Andrew D., Jr., Conservation of thermal energy, 18: 17257
SVIRIDOV, V. A., $(CH_2)n$ thin films as synchrocyclotron targets, 18: 16794
SVIRIDENKO, I. P., Heat transfer in liquid metals flowing through pipes, 18: 17173 (NP-13656)
SWAIN, A. D., Performing human-factors reliability analysis, 18: 17358 (SC-R-685)
SWARTZ, Howard A., Light filter for reduction of background in liquid scintillation counting, 18: 16307 (TID-7689(p.31-3))
SWEET, William H., Labeling of human globulin with I-124, 18: 15933
SWEETMAN, D. R., Ionization of excited H atoms by strong electric fields, 18: 16709
SWERDLOW, Martin A., Observations in radiation nephritis, 18: 15862
SWIRBALUS, R. A., Index of Ionospheric Storminess, 18: 16845
SZABO, I., Excitation of C-12 by scattering of neutrons, 18: 16967
SZMIDER, J., Polarization of neutrons from $D(d,n)He^3$, 18: 16992
SZYMAKOWSKI, J., Polarization of neutrons from $D(d,n)He^3$, 18: 16992

T

TABOLINA, L. N., Space distribution of dose streams of capture γ radiation, 18: 16962
TAGAMI, Y., Analytical method in statistical mechanics, 18: 16487 (UCRL-Trans-1030(L))
TAHERZADEH, M., Isotopic spin of the η meson, 18: 16783
TAKAGI, Yutaka, Infrared absorption spectrum of γ-irradiated $NaNO_3$, 18: 16100
TAKAHASHI, Yasushi, Hartree-Fock solution in field theory, 18: 16814
TALANIN, Yu. N., Radiation effects in solids, 18: 16539
TALANOV, V. D., Heat transfer in liquid metals flowing through pipes, 18: 16173 (NP-13656)
TAMAGUINI, C., Fast multiplication factor in cylindrical symmetry, 18: 17282 (CEA-tr-X-319)
TAMURA, Taro, Scattering of protons by Ho-165, 18: 16940 (ANL-6848 (p.24-9))
TAMURA, Tsuneo, Ion exchange reactions for Cs and Sr by soil minerals, 18: 17344
TANAKA, Shigetoshi, Microwave radiation from plasma. I., 18: 17147
TANAKA, Shigetoshi, Microwave radiation from plasma. II., 18: 17148
TANAKA, Toshikatsu, Radiation damage and annealing in Si, 18: 16534
TANAKA, Y., Helium and Ar emission continua, 18: 16717
TANI, E., Nuclear needle for neurosurgery, 18: 15912 (ACRH-20(p.25-36))
TANIGAWA, Tsuyoshi, Production of CoF_3, 18: 17374 (UCRL-Trans-1043(L))
TANKA, D., Changes in spleen after irradiation, 18: 15822
TANNER, N. W., Fluctuations in radio astronomy, 18: 16637
TAPLIN, G. V., Immunogenicity of irradiated *Mycobacterium tuberculosis*, 18: 15824
TARRAGO, X., De-excitation of Dy obtained by proton bombardment of Tb, 18: 16975
TARTAGLIONE, E., Relaxation-time determination in quadrupolar resonance, 18: 16041
TAS, A., Critical facility KRITO, 18: 17276 (EUR-498.e)
TAS, A., Subcritical facility PUK, 18: 17277 (EUR-499.e)
TASSINARI, A. F., Bi-directional decade counter, 18: 16313
TATISCHEFF, B., Strongly excited levels of C-12 by polarization of scattered protons, 18: 17044
TAYLER, R. F., Note on metal-deficient red giant stars, 18: 16634
TAYLOR, Aubrey E., Use of isotopes for determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
TAYLOR, H. S., Study of the LiH molecule, 18: 16671
TAYLOR, Howard S., Second-order perturbation theory in quantum mechanics, 18: 16801
TAYLOR, J. L., Tensile properties of pyrolytic W, 18: 16504
TAYLOR, K., Prog. rpt. on carbide fuel development, 4–6/63, 18: 16426 (UNC-5068)
TAYLOR, Lauriston S., Application of norms of external radiation, 18: 16255
TAYLOR, M. J., Raman spectra of ices Ih, Ic, II, III, and V, 18: 16023
TAYLOR, R. F., Recovery of fission product Kr from nuclear fuels, 18: 16136
TAZZIOLI, F., Deflector for Adone, 18: 16610 (LNF-63/72)
TCHEN, C. M., Plasma oscillations with collective correlations, 18: 17200
TCHKOUACELI, D. V., Charge exchange between ions and atoms of alkaline and alkaline-earth metals, 18: 16727
TEITELMAN, B., Direct reaction contributions to fluctuating reaction cross sections, 18: 16938 (ANL-6848(p.228-9))
TELICH, J., Working conditions and radiation levels at mines, 18: 16240
TEMMER, G. M., Contributions to nuclear reaction cross sections, 18: 17078
TEMMER, G. M., Direct reaction contributions to fluctuating reaction cross sections, 18: 16938 (ANL-6848(p.228-9))
TEMMER, G. M., Singlet di-nucleon state in nuclear reactions, 18: 16932 (ANL-6848(p.180-1))
TEMPERLEY, H. N. V., Mutual cancellation of cluster integrals, 18: 16572
TEMPLETON, W. L., Concentrations of Ca, Sr, and Sr-90 in wild brown trout, 18: 16243
TEPLY, Jiri, Radiation effects on extractions and extractants, 18: 16143
TERAO, Nobuzo, Structure of Nb carbides, 18: 16507
TERENIN, A. N., Hydrogen bonding with $UO_2(NO_3)_2 \cdot 6H_2O$, 18: 16043
TERRES, Geronimo, Enhanced antitoxin responses in irradiated mice, 18: 15856
TERUMICHI, Yasushi, Microwave radiation from plasma. II., 18: 17148
TERWILLIGER, K. M., p-p Elastic scattering with colliding beams, 18: 16751 (BNL-7534(p.238-52))
THAXTON, G. D., Analysis of $C^{13}(\alpha,n)O^{16}$ reaction, 18: 16937 (ANL-6848 (p.226))
THEIMER, O., Kinetic and potential energy of an ionized gas, 18: 16662
THEVENET, B., Colliding beams to study intermediate boson, 18: 16752 (BNL-7534(p.308-11))
THIBAULT, C., Total cross section of Ni for neutrons of 175 to 300 kev, 18: 17038
THIRION, J., Polarized deuterons of Saclay cyclotron, 18: 16617
THIRION, J. M., Excited levels in F-19 by study of $O^{16}(p,\alpha_0)N^{13}$, 18: 17030
THOMA, H., Apparatus for fast liquid-liquid extraction, 18: 16146
THOMAS, G. H., Autoradiography of H-3 on chromatograms, 18: 15984
THOMAS, L., Occurrence of dense sporadic-E at magnetically conjugate points, 18: 16868
THOMAS, Lyle D., State's role in local radiation emergencies, 18: 16269
THOMAS, T. Y., Perfect relativistic gas, 18: 16570
THOMPSON, A. S., Prog. rpt. on high acceleration field heat transfer for SNAP, 9/62–8/63, 18: 17322 (TID-19971)
THOMPSON, W. B., Introduction to plasma physics, 18: 17192
THOMSON, J. R., Alloys of Th with transition metals. III., 18: 16501
THORNE, Anthony Charles, Protective clothing, 18: 16272
THORSON, W. R., Replacement and improvement of fixed radiation monitoring instrumentation, 18: 16297 (HW-79027)
THOUVENIN, P., Fluctuation of cross section of (n,α) on Si, 18: 16971
THROW, F. E., Conference on nuclear spectroscopy with direct reactions, University of Chicago, 3/64, 18: 16905 (ANL-6848)
THURBER, W. R., Electronic transport in Sr titanate, 18: 16045
TICHO, H. K., Isotopic spin of the η meson, 18: 16783
TIETZ, T., Eigenfunctions for the atomic field, 18: 16658
TIKHOMIROV, I. A., Isotope effects in reduction of HNO, to nitric oxides, 18: 16403
TILLES, David, Meteoritic H-3 and diffusion in Fe, 18: 16210
TJON, J. A., Relaxation in isolated spin systems, 18: 16046
TKACHENKO, E. A., Equation of state for *para* hydrogen, 18: 16654
TOBIAS, Cornelius A., Suppression of pituitary function in diabetic retinopathy, 18: 15927
TOBOCMAN, R. M. W., Remarks concerning reciprocity in quantum mechanics, 18: 16802
TOCCO, Dominick J., Residue studies with radioisotopic drugs, 18: 15784 (TID-7689(p.58-62))
TOLAR, J., Ground-state energy of nuclear matter, 18: 16960

TOLCHENOV, Yu. M., Corona discharge detectors for slow neutrons, 18: 16328
TOLKENDORF, E., Determination of β radioactivity in water, 18: 15982
TOLOK, V. T., Cherenkov absorption of "whistles" in plasma cylinder, 18: 17153
TOLOK, V. T., Cherenkov damping of h-f plasma oscillations, 18: 17154
TOLOK, V. T., Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)
TOLOK, V. T., Plasma injection into magnetic trap, 18: 17110 (NP-13623)
TONOLINI, F., Statistical model analysis of (n,α) reactions. I., 18: 17057
TONOLINI, F., Statistical model analysis of (n,α) reactions. II., 18: 17058
TONOLINI-SEVERGNINI, L., Statistical model analysis of (n,α) reactions. I., 18: 17057
TONOLINI-SEVERGNINI, L., Statistical model analysis of (n,α) reactions. II., 18: 17058
TORRES, H., Percutaneous cordotomy for pain, 18: 15734 (ACRH-20 (p.37-46))
TOTSKII, I. A., Elastic scattering of 0.65-Mev neutrons, 18: 17089
TOUGAS, R., Influence of electric current on segregation, 18: 17367 (AEC-tr-6376)
TOUGAS, Remi, Effect of electrical current on segregation, 18: 16428 (AEC-tr-6366)
TOUSCHEK, B. F., Italian storage rings, 18: 16586 (BNL-7534(p.171-208))
TRAFTON, G. A., Distribution of Cs-137 in mice and dogs after chronic exposure, 18: 15766 (LAMS-3034(p.41-8))
TRAFTON, G. A., Effect of exercise on excretion of Cs-137, 18: 15765 (LAMS-3034(p.34-40))
TRAFTON, G. A., Effect of temperature on retention of Sr in mice, 18: 15770 (LAMS-3034(p.65-72))
TRAFTON, G. A., Metabolism of Mn-54, 18: 15767 (LAMS-3034(p.49-52))
TRAFTON, G. A., Retention of Zr-95 in mice, 18: 15768 (LAMS-3034 (p.53-8))
TRAININ, N., Action of isologous bone marrow on radiation leukemogenesis, 18: 15899
TRAPP, John H., Influence of electric current on segregation, 18: 17367 (AEC-tr-6376)
TREHAN, S. K., Electron oscillations in bounded plasma, 18: 17180
TREHAN, S. K., Stability of inhomogeneous plasmas, 18: 16773
TREILLE, P., Summary of nuclear energy, 18: 17375
TREMILLON, Bernard, Separating Zr and Hf, 18: 16155
TRET'YAKOVA, V. P., Reactivating yeast organisms after radiation injury, 18: 15819 (UCRL-Trans-1029)
TREVETIN, J.-P., Discrimination of particles in organic scintillators, 18: 16324
TRIBUNO, C., Joint AN/CNEN/NPPC irradiation program, 18: 17328
TRILLING, George H., Evidence for π-ρ interaction produced in π^+-p reaction at 3.65 Bev/c, 18: 16790
TRIMM, David L., Kinetics of reduction of Co(III) complexes, 18: 16018
TROC, R., Magnetic properties of U phosphides, 18: 16488
TROUE, H. H., Characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
TRUESDALE, John C., Compilation of U.S. IGY-IGC rocket program results, 18: 16580
TRUJILLO, T. T., Aging in mice with different histories of ancestral x-ray exposure, 18: 15808 (LAMS-3034(p.116-23))
TRUJILLO, T. T., Chromatography of nucleic acids, 18: 15780 (LAMS-3034(p.350-72))
TRZEBIATOWSKI, W., Magnetic properties of U phosphides, 18: 16488
TSEKHMISTRENKO, Yu. V., Theory of nuclear reactions, 18: 17088
TSERKOVNITSKAYA, I. A., Amperometric titration of Th with Pt electrodes, 18: 15990
TSHUBAKOV, A. A., Chemical composition of eye lens at the time of radiation cataracts, 18: 15816 (CEA-tr-R-1635)
TSITOVICH, A. P., Mass distributions of heavy fragments by pulse analyzer, 18: 16338
TSKHAI, V. A., Concentration region of homogeneity of carbides of transition metals, 18: 16483 (AEC-tr-6374)
TSOI, A. Kh., Argon-filled spark chambers, 18: 16337
TS VETKOV, O. S., Neutron radiation of natural formations, 18: 16209
TSVETKOV, Yu. D., Radiation damage in some aliphatic acids and salts, 18: 16091
TULLY, John C., Effects of electron transfer on high-resolution NMR spectra, 18: 16027
TUPPER, B. O. J., Partition of energy in cosmical physics, 18: 16815
TURI, L., Determination of β^{eff}/l on ZR-1 assembly, 18: 17284
TURNER, James O., Index of engineering notes and specifications, 18: 16160 (UCRL-11200(Vol.1))
TURRIN, A., Collection of positive ions by a probe, 18: 17186
TYAGUNOV, G. A., Accelerators, 18: 16620

U

UEHLINGER, A., Gammacardiography, 18: 15925
UENO, Y., Radiosensitivity and SH compounds in mammalian cells, 18: 15897
UGO, A., Lipid component of arterial elastica, 18: 17373 (UCRL-Trans-1033)
UHLMANN, W., Bibliography on radiation effects on nuclear fuel materials, 18: 16529 (VDIT-16(4.1))
ULEHLA, I., Perturbation theory for system of many fermions, 18: 16800
UMEZAWA, Hiroomi, Hartree-Fock solution in field theory, 18: 16814
UPADHYAY, S. R., Annealing of chemical radiation damage, 18: 16103
UPHAUS, R. A., Effect of D_2O on growth of peppermint. I., 18: 15861
UPTHEGROVE, William R., Diffusion phenomena in liquid Cd–Pb binary system, 18: 16480 (TID-20326)
URBANEC, Z., Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)
US, V. S., High-frequency field strength measurements in plasma by Stark effect, 18: 17188
USACHEV, L. N., Kinetic energy of fragments in neutron induced fission of U-235 and U-233, 18: 16946 (NP-13654)
USHAKOV, P. S., Heat transfer in liquid metals flowing through pipes, 18: 16173 (NP-13656)

V

VAILATI, G., Nuclear needle for neurosurgery, 18: 15912 (ACRH-20 (p.25-36))
VAKHIDOV, Sh., Effects of electric treatment on luminescence of synthetic quartz, 18: 16121
VAKHNIN, V. M., Motion of charged particles in magnetic dipole field, 18: 16554 (FTD-TT-64-90(p.128-62))
VALADARES, M., Disintegration Pa-231 → Ac-227, 18: 16985
VALATIN, J. G., Magnetic field in superconducting films, 18: 16885
VALENTIN, A., Examination of irradiated Pu fuel elements, 18: 16163 (CEA-2395)
VALENTIN, J., Decay of W-176, 18: 16983
VAL'TSEV, V. K., Separation of lanthanides in NH_4NO_3 by zone crystallization. III., 18: 16137
VAN AKEN, J., Properties of dental x-ray films, 18: 15938
VAN ASSCHE, P., Excited levels in Tm-169, 18: 16982
VAN DER KAMP, Cornelia, Dark reactivation of uv-irradiated bacteriophage DNA, 18: 15832
VANDER MAAT, P., Polarization of neutrons from T(p,n)He^3, 18: 17052
VAN DER PLAS, Theo, Preparation of granular, ammonium uranyl sulfate, 18: 16065
VANDER VELDE, J. C., Determination of spin of f^0 resonance, 18: 16792
VAN DER VENNE, Marcel, Organic coolants on trial, 18: 17307
VAN DILLA, M. A., Effect of ashing temperature on Cs and K content of bone, 18: 15953 (LAMS-3034(p.201-4))
VAN DILLA, M. A., Evaluation of K-40 continuum contribution to Cs-137 photopeak in spectrometer, 18: 16302
VAN DILLA, M. A., Metabolism of radioiodine in children and adults, 18: 15775 (LAMS-3034(p.187-200))
VAN DILLA, M. A., Retention of Cs-137 by adults, 18: 15774 (LAMS-3034(p.184-6))
VAN DILLA, M. A., Whole-body γ spectrometer for K and Cs-137, 18: 16301 (LAMS-3034(p.152-61))
VAN DINGENEN, W., Scattering of cold neutrons by protons, 18: 17081
VAN ECK, J., Electron capture into an excited state by H^+ and He^+, 18: 16705
VAN ELST, H. C., Prog. rpt. on determination of ductile-brittle transition temperature, 10–12/63, 18: 16470 (EURAEC-913)
VAN KEMPEN, H., Heat capacities of Tb and Ho, 18: 16516

VAN LEUVEN, P., Semiclassical description of nuclear vibrations, 18: 16981
VAN LINT, V. A. J., Ionization afterglow measurements on N, 18: 17141
VAN RINSVELT, H., Reaction $Si^{30}(p,\gamma)P^{31}$ between 1 and 1.53 Mev, 18: 17080
VAN ZANDT, T. E., Model of atmosphere and ionosphere in E and F1 regions, 18: 16850
VARNER, J. E., Prog. rpt. on biochemistry of senescence in plant cells, 6/63–3/64, 18: 17361 (TID-20353)
VARNEY, R. N., Drift velocity of ions in N, 18: 16060
VARNEY, R. N., Drift velocity of ions in Hg vapor, 18: 16061
VASIL'EV, A. M., Effect of electric field on NMR, 18: 17065
VASIL'EV, E. A., Electron component of betatron radiation, 18: 16625
VASTEL, M., Interaction of resonance neutrons with nuclei. I., 18: 17033
VASTEL, M., Interaction of resonance neutrons with nuclei. II., 18: 17034
VASTEL, M., Interaction of resonance neutrons with nuclei. III., 18: 17035
VASTEL, M., Interaction of resonance neutrons with nuclei. IV., 18: 17036
VEDRENNE, Gilbert, Interaction of 14.1-Mev neutron with D, 18: 16964
VEIL, E. I., Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)
VEILLET, J. J., Pion-nucleon cross section, 18: 16776
VELTMAN, M., Weak interactions of non-strange particles, 18: 16759 (CERN-64-13(Vol.III)(p.81-110))
VENTERS, Lydia, Strengthening of neutron-irradiated single crystals of Cu. I., 18: 16530 (AEC-tr-6373)
VERGEZAC, Pierre, Construction of time-of-flight spectrometer, using $D(d,n)He^3$, 18: 16323
VERGUN, A. P., Isotope effects in reduction of HNO_3 to nitric oxides, 18: 16403
VERHEYDEN, D. L. M., Synthesis of γ-P^{32}-labeled adenosine 5'-triphosphate, 18: 16085
VERLET, Loup, Theory of classical fluids. III., 18: 16569
VERNON, F. L., Jr., Prog. rpt. on low-temperature electronics, 7–12/62, 18: 16878 (SSD-TDR-63-98)
VERVIER, J., Angular correlations (γ-γ) in disintegration of Sb-124, 18: 17015
VERVIER, J., Decay scheme of 42-sec Rh-104, 18: 16989
VERVIER, J., Excited levels in Tm-169, 18: 16982
VERVIER, Jean, Comparison of the low-energy spectra of Cu-65 and V-51, 18: 16980
VEYRIE, P., Calculation of equation of state of H, 18: 16056
VICK, L. L. J., Pion-nucleon interaction and nucleon form-factors, 18: 16781
VICTOR, C., Device for multidimensional analysis in nuclear physics, 18: 16321
VIEHBOECK, F. P., Electromagnetic mass separation for cross section measurements, 18: 16950 (SGAE-PH-2/1964)
VIGASSY, J., Determination of β^{eff}/l on ZR-1 assembly, 18: 17284
VIKHROV, V. I., Techniques of irradiating materials in reactor, 18: 16526 (NP-13663)
VINCENTI, E., Spatio-temporal diffusion equation in two-group approximation, 18: 16890 (EUR-596.e)
VINOGRADOV, A. P., Principal characteristics of U geochemistry, 18: 16221
VINOGRADOV, N. I., Charged-particle diffusion in magnetic field, 18: 17227
VIRNOT, Alain, Improvements in swimming-pool nuclear reactors, 18: 17331
VITKOVITSKY, Ihor M., X-ray emission from exploding wires, 18: 16566
VITON, E. J., SNAP-2 rotational speed control, 18: 17319 (NAA-SR-6310)
VLASOV, V. G., Kinetics of alpha UO_2 dissociation, 18: 16011
VOELKL, Johann, Relaxation phenomena in cold-worked Cu, 18: 16484 (AI-Trans-34)
VOLPICELLI, G., Bubble motion in fluidized solid/gas systems, 18: 16181 (AERE-Trans-997)
VON ENGEL, A., Flame plasma, 18: 17213
VON ENGEL, A., Measuring electron drift velocities, 18: 16723
VON GUNTEN, H. R., Electrodeposition of ThO_2 on Al, 18: 16460
VON HAGENOW, Karl Ulrich, Partition function of fully ionized gas, 18: 17207
VON ROSENBERG, Hermann E., Conservation of thermal energy, 18: 17257
VORNUM, G., Electrolytical Fe-55 source production, 18: 16404
VORTMAN, L. J., Construction of sea level, transisthmian canal using nuclear explosives, 18: 16161 (SC-4929(RR))
VOSE, P. B., Ion absorption by banana leaf disks, 18: 15798
VOSLAMBER, D., Relaxation of electron and ion temperatures in strong magnetic field, 18: 17217
VRBA, M., Attempt to detect and titrate Rous sarcoma virus-producing cells, 18: 15838
VRIENS, L., Ionization cross sections of He, He^*, He^+, Ne, Ne^*, Ne^+, Ar, Ar^*, Hg, and Hg^*, 18: 16661
VYAL'TSEV, A. N., Lightest atomic nuclei, 18: 17097

W

WAGHMARE, Y., Weakly coupled vibrations of a $f_{7/2}$-particle, 18: 17075
WAGNER, Richard H., Redundant pulse-height discriminator, 18: 16284
WAGONER, Ann, Compilation of U.S. IGY-IGC rocket program results, 18: 16580
WAKI, Hirohiko, Anion exchange separation of Ca and Sr, 18: 16132
WALDMANN, L., Kinetic equations for para-ortho H mixtures, 18: 16047
WALEN, R. J., Alpha spectrography of Ra-226 and levels of even-A Rn isotopes, 18: 16984
WALKER, W. D., High-energy physics with large heavy-liquid bubble chamber, 18: 16293 (BNL-7534(p.107-12))
WALL, Nathan S., Particle hole calculation of $Ca^{40}(\alpha,\alpha')$, 18: 16919 (ANL-6848(p.108-13))
WALLAUSCHEK, E., Radioactive waste disposal into North Sea, 18: 17334 (NP-13756(Vol.I))
WALLAUSCHEK, E., Radioactive waste disposal into North Sea, 18: 17335 (NP-13756(Vol.II))
WALLER, H. D., Landscape investigations using Cs-137, 18: 15762
WALLER, Ivar, Effect of impurities on neutron scattering by crystals, 18: 16434
WALLER, M., Recording of rapidly changing radioactive counting rates, 18: 16311
WALLING, J. F., Corresponding states behavior of Na, K, Rb, and Cs, 18: 16035
WALLMARK, J. T., Field-effect transistor, 18: 16282
WALSH, John J., Transfer of Se-75 across pericardium of dogs, 18: 15804
WALTER, G., Discrimination of particles in organic scintillators, 18: 16324
WALTER, R. L., Neutron polarization and cross sections for $C^{13}(d,n)N^{13}$ reaction, 18: 16908 (ANL-6848(p.16-23))
WALTERS, R. J., Prog. rpt. on HNPF operations, 3–8/63, 18: 17300 (NAA-SR-9265)
WANG, L., Lithium drifted Si surface barrier detector, 18: 16314
WARBERG, H. S., EOCR for testing fast reactor fuels, 18: 17247 (APDA-158)
WARD, H. W. C., Electron therapy at 15 Mev, 18: 15923
WARNER, Philip Cloudesley, Nuclear reactors, 18: 17274
WARWICK, C. S., Relation of solar active regions to ionospheric disturbances, 18: 16842
WASSON, H. R., Response of portable radiation instruments, 18: 16309 (USNRDL-TR-701)
WATANABE, Nobuatsu, Production of CoF_3, 18: 17374 (UCRL-Trans-1043(L))
WATSON, H. E., Prog. rpt. on irradiation effects on structural materials, 11/62–1/63, 18: 16527 (NRL-Memo-1393)
WATSON, R. E., Theory of spin-orbit coupling in atoms. III., 18: 16664
WATSON-MUNRO, C. N., Prog. rpt. on plasma physics, 7–12/63, 18: 17117 (NP-13743)
WATT, D. E., High-sensitivity counting techniques, 18: 16354
WATTS, J. M., Study of F2 layer effects by Doppler technique, 18: 16833
WAYNE, R. C., Anomalous nuclear magnetic resonance linewidth in Li, 18: 17077
WAYNE, W. D., ML-1 nuclear power plant initial power tests, 18: 17313
WEAVER, J. M., Whistler-mode propagation in laboratory plasma, 18: 17187
WEBBER, W., Behavior of the D layer under bombardment from solar cosmic rays, 18: 16642
WEBER, Gunter G., Mobility of Li in He, 18: 15994 (AD-416506)
WEBER, Gunter G., Interaction of two-electron atoms and ions, 18: 16657

WEBSTER, R. K., Determination of Rb and Cs in stony meteorites, 18: 15976
WEDEMEYER, E. H., Interferometric analysis of axisymmetric plasma flow, 18: 17175
WEED, S. B., Comparison of Mg^{2+}, Ca^{2+}, and Sr^{2+} as exchange ions for mineralogical studies of clays, 18: 16200
WEHRLI, W. E., Synthesis of γ-P^{32}-labeled adenosine 5'-triphosphate, 18: 16085
WEIGLE, William O., Effect of x irradiation on immunologic tolerance in rabbit to bovine serum albumin, 18: 15857
WEIL, Carrol, Radiation effect on the kidney, 18: 15880
WEIL, J. L., Reactions (He^3,n), 18: 16935 (ANL-6848(p.199-207))
WEILAND, Raymond L., Cesium-137 burdens in defined population sample, 18: 16232 (TID-18603)
WEINREICH, Marcel I., Developments in rapid nuclear electronics, 18: 16310 (SC-T-64-46)
WEINREICH, Marcel I., Ion and electron conduction in binary oxides, 18: 17370 (SC-T-64-44)
WEINREICH, Marcel I., Properties of rubber types, 18: 17371 (SC-T-64-45)
WEINSTOCK, Jacques, Prog. rpt. on removal of metallic ions by foaming agents, 7/62–6/63, 18: 16129 (RAI-116)
WEINZIERL, P., Electromagnetic mass separation for cross section measurements, 18: 16950 (SGAE-PH-2/1964)
WEISNER, J. D., Binding energy of H^-, 18: 16674
WEISS, George H., Preservation of canonical distribution in Markovian relaxation processes, 18: 16417
WEISSMAN, S. I., Luminescence of rare-earth chelates, 18: 16089
WENTORF, Robert H., Jr., Radioactive diamond composition, 18: 16436
WERBROUCK, A., Notes on the Monte Carlo method, 18: 16409 (CERN-64-13(Vol.I)(p.147-67))
WERNER, Gottfried, Synthetic incorporation of C-14 into tropine, (±) tropic acid, and atropine, 18: 16069
WERNER, L., Decay of Ag-110m, 18: 17051
WESCOTT, E. M., Conjugate point relationships at high latitudes, 18: 16869
WEST, Charles D., Synthesis of ring-labeled L-thyroxine-C^{14}, 18: 16074
WEST, E. J., Thermoluminescence methods in personnel dosimetry, 18: 16361
WESTENBARGER, Gene A., Polarization of Ag nuclei in ferromagnets and magnet field, 18: 16954 (UCRL-11143)
WESTPHAL, W. H., Local seismic monitoring at Shoal, 18: 16190 (NP-13757)
WETZEL, Klaus, Obtaining D-enriched H compounds, 18: 16405
WHALLEY, E., Infrared spectra of ices Ih and Ic, 18: 16021
WHALLEY, E., Infrared spectra of Ices II, III, and V, 18: 16022
WHALLEY, E., Raman spectra of ices Ih, Ic, II, III, and V, 18: 16023
WHEELER, B. R., Fluidized-bed calcination process for Al nitrate waste. III., 18: 17333 (IDO-14618)
WHEELER, C. B., Properties of non-fully ionized plasma, 18: 17212
WHEELER, Owen H., Etard reaction. IV., 18: 16072
WHEILDON, W. Maxwell, Flame-sprayed ceramic coatings, 18: 16521
WHIFFEN, D. H., Radiation damage in some aliphatic acids and salts, 18: 16091
WHIPPLE, Fred L., Observation of a solar-type radio burst from flare star, 18: 16638
WHITFIELD, A. G. W., Radiation damage to thoracic tissues, 18: 15888
WHITTIER, Angus Charles, Thermal neutron measuring device, 18: 16371
WIEGAND, D. A., Annealing of the x-ray-induced volume expansion and coloration of LiF, 18: 16107
WIEGAND, D. A., Color center behavior of NaCl irradiated at low temperature, 18: 16106
WIESE, W. L., Elastic scattering of slow electrons by H atoms, 18: 16690
WILF, Herbert S., Dirichlet series and Toeplitz forms, 18: 16415
WILIP, Elmar K., All-union conference on calorimetry, Leningrad, 6/63, 18: 17369 (ANL-Trans-4)
WILIP, Elmar K., D-Tryptophan in higher plants, 18: 17366 (AEC-tr-6363)
WILIP, Elmar K., Primary effects of phototropic perception, 18: 17365 (AEC-tr-6362)
WILIP, Elmar K., Thermal dissociation of ammonium polyuranate (ADU), 18: 16007 (AEC-tr-6377)
WILKIE, J. R., Micropulsation studies at Brisbane. II., 18: 16863
WILKINS, D. E., Silage density measured by γ attenuation, 18: 16393 (TID-7688(p.106-13))
WILLAIN, C., Scattering of α particles by light nuclei, 18: 17019
WILLIAMS, D. A., Low-energy collisions between H atoms and protons, 18: 16684
WILLIAMS, D. H., Response of portable radiation instruments, 18: 16309 (USNRDL-TR-701)
WILLIAMS, D. L., Oligonucleotide synthesis, 18: 15779 (LAMS-3034 (p.329-49))
WILLIAMS, J. B., Heavy-particle path lengths in cylinders, 18: 16316
WILLIAMS, J. N., Study of sources of ceramic inclusions in cast gas turbine components by radiotracer, 18: 16456 (TID-7689(p.119-25))
WILLIAMS, L. D., PRCF experiments with H_2O moderator, 18: 17298 (HW-80092)
WILLIAMS, Zelda M., Microbial survival in γ-irradiated soils, 18: 15885
WILLIAMSON, C., Cross sections for (n,p), (n,α), and (n,2n) on F-19 and Ne-23, 18: 16969
WILLIAMSON, C., Determination of neutron cross sections, 18: 16970
WILLIS, W. J., Elastic scattering of $\pi^{\pm}$-p, $K^{\pm}$-p, p-p, and $\bar{p}$-p, 18: 16749 (BNL-7534(p.83-7))
WILLIS, W. W., Fission rate activation in thermal test reactor, 18: 17278 (KAPL-M-6101)
WILLMORE, A. P., Plasma probe experiments on Ariel satellite, 18: 17191
WILLMORE, A. P., Results from the x-ray spectrometer in satellite UK1, 18: 16645
WILLS, J. G., Angular momentum selection and angular correlations in direct reactions with strongly absorbed particles, 18: 16927 (ANL-6848(p.147-52))
WILSON, A. G., Neutral cascade events from heavy liquid bubble chamber, 18: 16761 (NIRL/R/56)
WILSON, E., Thyroid and whole-body retention of I in box turtles, 18: 15781 (TID-7689(p.20-2))
WILSON, E. R., Beta-excited spectra, 18: 16650 (TID-7689(p.80-1))
WILSON, M. L., Metabolism of Vinca alkaloids, 18: 15790
WILSON, Willard E., Radiation-induced chlorination of toluene by stannic chloride, 18: 16094
WINAND, L., Angular distribution in reaction $Li^6(n,t)He^4$, 18: 16965
WINAND, R., Electrodeposition of Zr–Nb, 18: 16431
WING, G. M., Correction to invariant imbedding equations of transport theory, 18: 16899
WINNOWSKI, W. S., Radiochemistry during startup and operation of Savannah, 18: 17320 (NSEC-72)
WINTER, J., Gamma radiolysis of H_2O vapor, 18: 16105
WINTER-GEGAUFF, Christiane, Compound nuclei and tangential collisions in reactions of Ne-20 with Ag and Br, 18: 17010
WITTEN, Louis, Energy transfer in fast molecular ion collisions, 18: 16706
WOLFE, L. S., Radiation, radioactivity, and insects, 18: 15756
WOLFE, R. A., Diffusion in B.C.C. metals, 18: 16474 (NP-13738)
WOLTJER, L., Source of energy for radio galaxies, 18: 16636
WOOD, Henry L., Wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))
WOODHEAD, J. L., Nitrate complexes of U(IV), 18: 16029
WOODS, C. H., Plasma behavior in the Bumpy Torus, 18: 17171
WOODS, Frank W., Interspecific transfer of Ca-45 and P-32 by root systems, 18: 15757 (TID-7689(p.62-5))
WOODY-KARRER, Pearl, Resistance of *E. coli* S mutants to proflavine, 18: 15844
WORLEY, R. D., Characteristic x-ray production in the L shell of Cu, 18: 16663
WRIGHT, J. W., Temperature control of structure and variations of the quiet ionosphere, 18: 16849
WRIGHT, W. B., Jr., Prog. rpt. on thermionic cell collectors, 11/62–10/63, 18: 16742 (GA-4804)
WU, Ching-Sheng, Theory of plasma oscillations with pair correlations, 18: 17201
WU, T. H., Nuclear magnetic resonance study of H_2O in clay, 18: 16031
WUEHRMANN, A. H., X radiation in dental offices. II., 18: 16247
WUKUSICK, Carl S., Prog. rpt. on Cr-base alloys, 12/15/62–3/15/63, 18: 16423 (GEMP-197)
WYLLER, Arne A., Thermal conductivity tensors for weakly ionized air, 18: 17225

Y

YAEGER, James A., Response in rat incisor dentin to injected Sr, 18: 15792
YAKOVLEV, B. M., Device for determining center of γ beam, 18: 16350
YAMAWAKI, S., Fission of Th-232 induced by He ions, 18: 17067
YANG, Kuo-shen, g_0 Factor on nuclei, 18: 17095
YAVIN, A. I., Experiments with neutron-gas targets, 18: 16600 (BNL-7534 (p.406-13))
YEH, Ju-chiu, Amperometric titration of Th with Pt electrodes, 18: 15990
YERICK, R. E., Scintillator for neutron detection, 18: 16308 (TID-7689 (p.103-5))
YERICK, Roger E., Scintillation counting of I-129 and I-125, 18: 15961 (TID-7688(p.20-1))
YILDIZ, M., Some characteristic features of Cherenkov radiation, 18: 17190
YNTEMA, J. L., Nucleon capture reactions near A = 40, 18: 16931 (ANL-6848(p.177))
YODER, Robert E., Foam suppression of radioactive iodine and particulates, 18: 16128 (NYO-9324)
YOKOYAMA, Yuji, Determination of Mn-54 in Fe meteorite, 18: 15985
YONEZAWA, T., Behavior of F2 layer during severe magnetic storms, 18: 16858
YORK, M., Radiotracers for leak detection in Saturn vehicle, 18: 16392 (TID-7688(p.95-7))
YORK, N. B., Energy- and rate-dependence studies, 18: 16305 (NP-13748)
YOSHIMURA, A., Fission of Th-232 induced by He ions, 18: 17067
YOSHIZAWA, Shiro, Production of CoF_3, 18: 17374 (UCRL-Trans-1043(L))
YOUNG, J. A., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)
YOUNG, J. C., Prog. rpt. on integral neutron thermalization, 12/63, 18: 16891 (GA-4881)
YOUNG, J. E., Theory of intermediate structure, 18: 16941 (ANL-6848 (p.241-8))
YOUNG, John C., Boundary shape between plasma and magnetic field, 18: 17165
YOUNG, W. H., Electrical resistivity of alkali vapors, 18: 16513
YUASA, T., Study of $C^{13}(p,2p)B^{11}$ reaction with propane bubble chamber, 18: 17045
YUFEROV, V. B., Optimum parameters of GVL-2 magnetic system, 18: 17116 (NP-13711)
YUNUS, M., Luminescence of irradiated crystalline quartz, 18: 16120
YUTKIN, M. G., Cross sections of inelastic neutron collisions with Fe, Ni and Nb nuclei, 18: 16958 (NP-tr-1114)
YVON, P., Inelastic scattering of 800-kev neutrons by I-127, 18: 17039

Z

ZABIYAKIN, G. I., Singularities in multichannel detection devices, 18: 16340
ZABUSKY, Norman J., Nonlinear Vlasov equation, 18: 16819
ZACHARISEN, D. H., Study of F2 layer effects by Doppler technique, 18: 16833
ZAKHAROV, A. M., Investigation of Nb–W–Zr and Nb–Mo–Zr, 18: 16494
ZAKSE, Gyuster, Scintillation measuring head, 18: 16374
ZAMICK, L., Selection rules in $Ti^{48}(p,p')$ inelastic scattering, 18: 16930 (ANL-6848(p.168-71))
ZAMIR, David, Anomalous nuclear magnetic resonance linewidth in Li, 18: 17077
ZAMOSHNIKOVA, N. N., Inhibiting properties of pertechnetate ion, 18: 16443 (ORNL-tr-32)
ZAMUDIO C, J., Angular correlations in (d,p) stripping reactions on Be-9 and Ca-40, 18: 16993
ZAPPA, L., Positron annihilation in alkali halides, 18: 16665
ZARE, Richard N., Vibrational structure of electronic band systems, 18: 16651 (UCRL-10925)
ZATZICK, M. R., Lithium drifted Si surface barrier detector, 18: 16314
ZAVITSAS, Andreas A., Transition state in methyl radical formation, 18: 16086
ZAYMOVSKII, A. S., Influence of cyclic thermal loading on metals, 18: 16492
ZEEMAN, E. C., Causality implies the Lorentz group, 18: 16805
ZEMANOVA, Jaroslava, Separation of Zr^{95}–Nb^{95} from fission product solution, 18: 16144
ZENK, M. H., D-Tryptophan in higher plants, 18: 17366 (AEC-tr-6363)
ZENK, M. H., Primary effects of phototropic perception, 18: 17365 (AEC-tr-6362)
ZHEREBTSOVA, K. I., Calibrated multi-angle magnetic analyzer-multispectrograph, 18: 16331
ZHEREBTSOVA, K. I., Differential cross section for proton groups from $Al^{27}(d,p)Al^{28}$, 18: 17091
ZHEREBTSOVA, K. I., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092
ZHEREBTSOVA, K. I., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
ZHURAVLEV, D. A., Cosmic radiation beyond atmosphere, 18: 16732 (FTD-TT-64-90(p.163-76))
ZHYLINSKII, A. P., Charged-particle diffusion in magnetic field, 18: 17227
ZIEGLER, C. A., Sediment gage for rivers and streams, 18: 16195 (TID-7689(p.142))
ZIEMBA, F. P., Lithium drifted Si surface barrier detector, 18: 16314
ZIESEL, Jean-Pierre, Formation of multiple charged ions by Auger effect, 18: 16698
ZIJP, W. L., Critical facility KRITO, 18: 17276 (EUR-498.e)
ZIMIN, E. P., Cross section of collisions of electrons with neutral atoms, 18: 16702
ZIMIN, E. P., Properties of slightly ionized gaseous mixtures, 18: 16062
ZIMMERMANN, Kenneth A., Assaying system for HTGR fuel compacts, 18: 17265
ZIZKA, Emil, Production of high-temperature plasma, 18: 17242
ZOBEL, W., Multicrystal γ spectrometer, 18: 16315
ZOELLER, O., Thermal instability of plasma column, 18: 17229
ZOLOTAREV, V. S., Reactions (d,p) and elastic scattering (d,d) on nuclei. I., 18: 17092
ZOLOTAREV, V. S., Reactions (d,p) and elastic scattering (d,d) on nuclei. II., 18: 17093
ZOLOTOTRUBOV, I. M., Plasma injection into magnetic trap, 18: 17110 (NP-13623)
ZRELOV, V. P., Polarization selectivity of Cs oxide photocathodes, 18: 16346
ZUKAKISHVILI, G. G., Plasma properties in theta pinch, 18: 17159
ZUROMSKY, G., Prog. rpt. on UO_2 fuel systems, 10–12/63, 18: 16422 (CEND-204)
ZVEREV, B. P., Application of $B^{10}(n,\alpha)Li^7$ reaction to determination of B in Si, 18: 15993
ZVYAGIN, V. I., Application of $B^{10}(n,\alpha)Li^7$ reaction to determination of B in Si, 18: 15993
ZVYAGIN, V. I., Effects of nuclear emission on SiC luminescence, 18: 16122
ZYKOV, V. G., Interaction of plasma flows in transverse magnetic field, 18: 17115 (NP-13706)
ZYUBKO, V. A., Apparatus for measuring angular distribution of annihilation radiation of positrons, 18: 16304 (NP-13693)

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is indentifiable by the absence of a report number.

General Indexing Style

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Diseases and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair. However, the information would not be indexed under the experimental animal, e.g., Rats, unless the report discusses the effects on rat hair as compared with the effect on the hair of other animals.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings or, in some cases, subheadings; e.g., Amino Acids rather than Acids, amino; Helium Isotopes He-4 rather than Helium—isotopes He-4 or Helium—He-4 isotopes. Note, however, that in some cases modifying terms are used parenthetically in preference to a more direct type of entry which would result in the scattering of information. Organic compounds, however, are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of *Chemical Abstracts*, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid—methyl ester.

Alphabetization

Main headings are arranged according to the widely accepted word-by-word alphabetic system. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out, e.g., Mesons (π), Mesons (ξ).

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

Multicomponent Systems

Multicomponent alloys, except well-known trade names are indexed under each element in the alloy.

Example: Aluminum–Chromium Alloys are indexed

ALUMINUM ALLOYS
Al–Cr ...
CHROMIUM ALLOYS
Al–Cr ...

Well-known alloys such as Hastelloy are indexed directly with cross references under the element components. Multicomponent systems of elements are indexed similarly.

Example: Silicon–Tungsten Systems are indexed

SILICON SYSTEMS
Si–W ...
TUNGSTEN SYSTEMS
Si–W ...

Multicomponent systems of compounds are similarly indexed under the compound.

Physical States of Materials

In this subject index specification of the physical state of the material, if other than normal, is included in the modifying phrase.

Modifying Phrases (Subheadings)

Descriptive phrases (modifiers),,rather than ordinary subheadings, are used under the main headings to give a better indication of the material covered in an abstract than would be possible with only a word or two whenever it appears that such information would be useful. Such phrases are written so that the idea considered most important is presented first, should a not-too-awkward expression result. However, when using this index, the reader is advised to scan all modifiers under a main heading to determine whether any abstracts in addition to the most obvious should be consulted for the desired information. Many of the modifiers are designed to be read in inverted order or to be read with the main heading inserted at the position of the comma in order to obtain a meaningful phrase; e.g., Uranium—allotropic transformation temperatures of, effect of cooling rate on is read "effect of cooling rate on allotropic transformation temperatures of uranium." In many cases, the prepositions have been omitted from such phrases provided no ambiguity results from the omission.

A

A-286 ALLOY
radiation effects on electric and mechanical properties of, 18: 16424(R) (GEMP-270A)
ABRASION
control of, radiometric device for, 18: 16394
ABSTRACTS
on plutonium technology, 18: 17353 (HW-68600-35)
ACCELERATORS
beam bending from, design of apparatus for, 18: 16627(P)
beam pulsation from, with 5 Mc/sec repetition rate, 18: 16614
book: *Accelerators*, 18: 16620
bubble chambers for high-energy, possible uses of, 18: 16294 (BNL-7534 (p.113-27))
characteristics of surface-contact-ionization Hall-current, 18: 16559
charged particle beam bending from, for scanning surfaces, 18: 16628(P)
charged particle motion in circular, 18: 16612
conference on storage rings, accelerators, and experimentation at super-high energies, Brookhaven National Lab., June 10 to July 19, 1963, 18: 16583 (BNL-7534)
development and evolution of, review, 18: 16613
experiments with neutron-gas targets, 18: 16600 (BNL-7534(p.406-13))
magnetic field measurements in a-c, design of electron tube for, 18: 16626
operation of weak-focusing, effects of sector angle dynamics on, 18: 16623
plasma, design of electromagnetic, 18: 17241(P)
principles and uses, 18: 17375
prospects of high-energy high-intensity, 18: 16597 (BNL-7534(p.385-91))
radioisotope production in components of high-energy high-intensity, 18: 16598 (BNL-7534(p.392-8))
space-charge effects in circular, intensity limitations from transverse, 18: 16593 (BNL-7534(p.324-67))
storage ring design for, 450-Mev electron and positron, 18: 16609 (LAL-1081)
storage ring development for Stanford electron, 18: 16587 (BNL-7534 (p.209-27))
storage ring development for colliding-beam experiments, 18: 16591 (BNL-7534(p.253-76))
storage ring developments for, 18: 16753 (BNL-7534(p.312-17))
storage ring future applications in high-energy physics, 18: 16590 (BNL-7534(p.236-7))
storage ring studies at CERN, 18: 16585 (BNL-7534(p.128-70))
storage ring uses for colliding-beam experiments, 18: 16592 (BNL-7534 (p.277-307))
storage rings "AdA" and "Adone" for, development of, 18: 16586 (BNL-7534(p.171-208))
storage rings for nonlinear-focusing, Orlov proposal for, 18: 16599 (BNL-7534(p.399-405))
superconductor applications in, 18: 16602 (BNL-7534(p.417-47))
use as proton sources in radiobiology, 18: 15866
use of 1000-Bev, for neutrino experiments, 18: 16750 (BNL-7534 (p.88-106))
use of 600- to 1000-Bev, for study of proton scattering of elementary particles, 18: 16749 (BNL-7534(p.83-7))
ACETIC ACID
deuterium-hydrogen exchange between chlorophyll and, location of, 18: 16042(T)
ACETIC ACID, (ETHYLENEDIAMINE)TETRA- COMPLEXES
with iron, analytical use for determination of thorium in uraninites, 18: 15990
ACETONE
acetone–HCl, sorption by cellulose ion exchangers of metal ions from, 18: 16140
ACETONE, THENOYLTRIFLUORO- CHELATES
with europium and terbium, luminescence decay of, 18: 16089
ACETYLENE
neutron total cross sections of solid, cold, 18: 17081
ACIDS
separation from Purex waste solutions using Alamine-336, 18: 16377(R) (ORNL-TM-515)
ACRYLIC ACID, β-CYANOETHYL ESTER
radioinduced polymerization with ethyl vinyl sulfone, 18: 17351(R) (BMI-1659(Del.))
ACRYLONITRILES
radioinduced polymerization of, use for study of polymerization mechanism, 18: 16077 (NP-13734)
ACTINIUM ISOTOPES Ac-224
production in proton reactions with thorium-232, 18: 16976
ACTINIUM ISOTOPES Ac-225
production in proton reactions with thorium-232, 18: 16976
ACTINIUM ISOTOPES Ac-226
production in proton reactions with thorium-232, 18: 16976
ACTINIUM ISOTOPES Ac-227
desorption from stainless steel, 18: 16376(R) (MLM-1157)
energy levels and gamma spectra of, 18: 16985
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
production in proton reactions with thorium-232, 18: 16976
ACTINIUM ISOTOPES Ac-228
production in proton reactions with thorium-232, 18: 16976
ACTINOMYCIN
effects on nucleic acid synthesis in barley seed, 18: 17361(R) (TID-20353)
ACTIVATION ANALYSIS
foil techniques in neutron, method for evaluating effective threshold in, 18: 16367
method for determining neutron flux, 18: 16356
method for neutron dosimetry, 18: 16355
method for sulfur determination in algal polysaccharides, 18: 15965
principles and techniques of neutron, 18: 15951(R) (GA-4855)
survey, 18: 15956 (NP-13762)
use in identifying drugs, 18: 15977
use of Van de Graaff accelerator as fast neutron source in, 18: 15955 (NP-13761)
ADDITION COMPOUNDS
stability of argon clathrate of hydroquinone, radiation and thermal, 18: 16084
ADENINE
radiosensitivity effects in therapy for cancer and other diseases, 18: 15902
ADENOSINE
separation of, chromatographic, 18: 15780(R) (LAMS-3034(p.350-72))
ADENOSINEPHOSPHORIC ACIDS
synthesis of phosphorus-32 labeled, 18: 16085
ADHESIVES
development of explosive-compatible, 18: 16376(R) (MLM-1157)
ADRENAL GLANDS
calcium-47 distribution and kinetics in dogs as affected by steroids of, 18: 15795
radiation effects on hormone production in rat, x, 18: 15842
ADRENAL HORMONES
radiation effects on rat, x, 18: 15842
AEROSOLS
book: *Pulmonary Deposition and Retention of Inhaled Aerosols*, 18: 15806
pulmonary deposition and retention of inhaled, 18: 15806
AGE ESTIMATION
book: *Absolute Geochronology of the Quaternary Period*, 18: 16219
AGING
effects on response of monkeys to training, 18: 15850
radiation effects on, in mice, 18: 15808(R) (LAMS-3034(p.116-23))
AGRICULTURE
silage density measurement using gamma energy attenuation, 18: 16393 (TID-7688(p.106-13))
AIR
analysis for toxic particles, spectrographic, 18: 16271(P)
electric discharges in, afterglow tails from, 18: 17235
iodine removal from, by foam, 18: 16128 (NYO-9324)
ionization in upper atmosphere, model for, 18: 16850
monitoring for uranium dust, alpha detector for, 18: 16298 (K-1589)
motion in ionospheric E and F layers, 18: 16865
motion of neutral, effects on drifts in ionospheric F layer, 18: 16867
proton energy losses in, 18: 16713

radioactivity monitoring in, design of alarm system for, 18: 16273(P)
separation of iodine-131 from hot off-gas system by charcoal column, 18: 16230 (TID-7688(p.68-74))
separation of oil mist from compressed, tracer method for measuring filter efficiency for, 18: 16388 (TID-7688(p.78-80))
thermal conductivity tensors for weakly ionized, 18: 17225
air–water, two-phase flows on four-rod assembly, effects of twist strips on, 18: 16182(T) (EURAEC-638)

AIRCRAFT
analysis of vibrations in flight, system for, 18: 16280 (SC-TM-328-62(72))

ALANINE
radiolysis using constricted air spark light source, pulse, 18: 16101

ALARM SYSTEMS
design criteria for modification of fixed monitoring instrumentation in Hanford production reactor areas, 18: 16297 (HW-79027)
development for radioactivity air sampling monitor, 18: 16273(P)

ALBUMINS
chromium-51-labeled blood serum, stability of, 18: 15793

ALGAE
sulfur determination in polysaccharides of, neutron activation method for, 18: 15965

ALIZARIN RED S COMPLEXES
with scandium and yttrium, composition, nature, and stability of, 18: 16039

ALKALI METAL HALIDES
electric field gradients due to strains in crystalline, from gradient-elastic tensor determination, 18: 16562
positron annihilation in, 18: 16665

ALKALI METAL IONS
charge exchange with alkali metal and alkaline earth atoms, 18: 16727

ALKALI METALS
analysis of, bibliography on methods for, 18: 15964 (WCAP-2540)
charge exchange with alkali metal and alkaline earth ions, 18: 16727
determination in tungstates and tungsten bronzes, 18: 15952 (IS-800)
electric conductivity of high-density vapors, 18: 16513
ionization cross sections, 18: 16666

ALKALINE EARTH IONS
charge exchange with alkaline earth atoms and alkali metal atoms, 18: 16727

ALKALINE EARTH METALS
charge exchange with alkaline earth ions and alkali metal ions, 18: 16727

ALKALOIDS
preparation of tritiated vinblastine, 18: 15790

ALLOYS
book: *Corrosion of Metals and Alloys*, 18: 16446
book: *Problems in Metal Physics and Metallography*, 18: 16432
Ising model of, analytical method for, 18: 16487(T) (UCRL-Trans-1030(L))

ALPHA DECAY
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in Russian, 18: 17096

ALPHA PARTICLES
biological effects in mammals, 18: 15826
chemical effects on cyclohexane, linear energy transfer effect in, 18: 16102
detection and discrimination using organic phosphors, 18: 16324
detection and measurement of, book on high-sensitivity, 18: 16354
detection and measurement of, from EBR I Mark IV plutonium fuel elements, 18: 17309
detection, dosimetry, and spectrometry of, in cylindrical systems, 18: 16316
diabetic retinopathy by hypophysectomy using, 18: 15927
distribution in cylinders, differential and integral, 18: 16316
effects on mouse skin, 18: 15827
kinetic energy conversion into electricity by "Triode", 18: 16745
polarization in emission by hydrogen atoms excited by particle impact, 18: 16714
properties of, book on, 18: 17097
reactions (α,Be^6) with magnesium-24 at 42 Mev, 18: 16951(R) (TID-20311)
reactions (α,d) of, $(d_{5/2})_1^1$ and $(f_{7/2})_1^0$ levels from, 18: 16933 (ANL-6848 (p.182-7))
reactions (α,d) with carbon-12, 18: 16934 (ANL-6848(p.188-98))
reactions (α,n) with carbon-13 at 12 to 22 Mev, analysis of, 18: 16937 (ANL-6848(p.226))
reactions (α,n) and (α,p) with nuclei, angular distributions of neutrons and protons from, 18: 16951(R) (TID-20311)
reactions (d,Li^6) with nuclei, 18: 16951(R) (TID-20311)
reactions with fluorine-19, gamma spectra of sodium-23 from, 18: 17001
scattering by calcium-40, particle-hole analysis of inelastic, 18: 16919 (ANL-6848(p.108-13))
scattering by light nuclei, cross sections for elastic, 18: 17019
scattering by medium-weight nuclei at 28.5 Mev, nuclear states from, 18: 17046
scattering by medium-weight nuclei, inelastic, 18: 16925 (ANL-6848(p.137-42))
scattering by nuclei, collective states from, 18: 17020
scattering by nuclei at 42 Mev, 18: 16951(R) (TID-20311)
scattering by 14-Mev level in carbon-12, 18: 16951(R) (TID-20311)
scattering of, angular momenta and symmetry in inelastic, 18: 16927 (ANL-6848(p.147-52))
scattering of, angular correlations in inelastic, 18: 16928 (ANL-6848(p.153-8))
spectra from neutron reactions at 14 Mev, 18: 17057

ALPHA SOURCES
recoil thrust on flat-plate, calculation, 18: 17324
use in low-thrust devices in space, 18: 17324

ALTERNATING-GRADIENT FOCUSING
Orlov proposal for azimuthally uniform field, 18: 16599 (BNL-7534 (p.399-405))

ALUMINUM
alpha reactions (α,n) at 42 Mev, angular distributions of neutrons from, 18: 16951(R) (TID-20311)
alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
analysis of pure, for iron by chromatographic separation and activation methods, 18: 15983
bonding of, gas-pressure, 18: 17351(R) (BMI-1659(Del.))
coating tubes of, with thorium dioxide by electrodeposition, 18: 16460
defect structure of, tritium decoration of, 18: 16478 (TID-7688(p.44-9))
determination in SAP, 18: 15949 (EUR-585.i)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
plasma of, x-ray emission from exploded-wire, 18: 16566
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (AI-Trans-38)
reactor criticality effects, 18: 16738 (KAPL-M-6121)
reduction of cerium and lanthanum oxide *in vacuo*, 18: 16430
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from acid solutions at 23 and 65°C, properties of D2EHPA for, 18: 16377(R) (ORNL-TM-515)
separation from D2EHPA, properties of acids for, 18: 16377(R) (ORNL-TM-515)
separation from Purex waste ruthenium extraction phase using D2EHPA, 18: 16377(R) (ORNL-TM-515)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
stability of, effects of thermal cycling on, 18: 16492
with electron reactions, photon emission from, 18: 16670

ALUMINUM ALLOYS
Al–brass, stability of, effects of thermal cycling on, 18: 16492
Al–Cr, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Al–Cr–Re, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Al–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496

Al–Pu, phase diagrams of, 18: 16493
Al–Pu, processing of irradiated, TBP process for, 18: 16152
ALUMINUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
ALUMINUM CARBIDES
melting temperature, evaluation for space technology, 18: 16521
ALUMINUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
ALUMINUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
ALUMINUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
ALUMINUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
ALUMINUM ISOTOPES Al-26
energy levels of, $(d_{s/2})^2$ and $(l_{1/2})^2$, 18: 16933 (ANL-6848(p.182-7))
ALUMINUM ISOTOPES Al-27
alpha scattering at 28.5 Mev, nuclear states from, 18: 17046
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
deuteron reactions (d,α), cross section fluctuations in, 18: 17072
deuteron reactions (d,p) at 6.6 Mev, differential cross sections for, 18: 17091
electron inelastic scattering at high energy, 18: 16944 (LAL-1091)
excitation of core of, model for, 18: 17021
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
neutron reactions (n,α) at 14 Mev, 18: 17057
proton inelastic scattering by, excited states from, 18: 17071
proton reactions (p,α), fluctuations in cross sections of, 18: 17078
ALUMINUM ISOTOPES Al-28
energy levels of, reduced width of 5.435 Mev, 18: 17091
preparation and properties of, for use as neutron sources, 18: 16379
ALUMINUM OXIDES
diffusion of iodine and rare gases in, 18: 16424(R) (GEMP-270A)
effects on strontium sorption by clay minerals, 18: 17344
electric properties, 18: 17370(T) (SC-T-64-44)
properties as fuel particle coatings, 18: 17351(R) (BMI-1659(Del.))
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
thermal conductivity of foams of, for use above 3000°F, 18: 16520
Al_2O_3–CaO–MgO–ZrO_2, phase studies on, 18: 16490
Al_2O_3–SiO_2, electric properties, 18: 17370(T) (SC-T-64-44)
ALUMINUM SILICATES
melting temperature, evaluation for space technology, 18: 16521
ALUMINUM SYSTEMS
Al–Si, effects of thermal cycling on stability of, 18: 16492
AMERICIUM
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
AMERICIUM COMPOUNDS
properties of, review of, 18: 16051
AMES LAB., AMES, IOWA
environs monitoring for radioactivity, 1962 and 1963, 18: 16205 (TID-20369)
AMINO ACIDS
content of survival foods, 18: 16237
synthesis and chemical structure of, 18: 15805
AMMETERS
description of, for pulsed currents in Ma range, 18: 17120 (RT/FI(63)-49)
AMMONIA
deuterium exchange between gaseous hydrogen and liquid, process and apparatus for, 18: 16406(P)
neutron total cross sections of solid, cold, 18: 17081
preparation of deuterium-enriched, 18: 16126(P)
AMMONIUM BROMIDES
trimethylstearyl-, sorption on HMX, tracer study of, 18: 16384 (TID-7688 (p.31-7))
AMMONIUM CHROMATES
radiation effects on, effects of radiation, thermal, and uv annealing on neutron, 18: 16114
Szilard-Chalmers reactions in, effects of thermal and uv annealing on, 18: 16115
AMMONIUM COMPOUNDS, QUATERNARY
Szilard-Chalmers reactions in tetramethyl ammonium dichromate, effects of thermal and uv annealing on, 18: 16115
trimethylstearylammonium bromide, sorption on HMX, tracer study of, 18: 16384 (TID-7688(p.31-7))
AMMONIUM FLUORIDES
NH_4F–DyF_3, chemical properties and crystal structure, 18: 16013
NH_4F–ErF_3, chemical properties and crystal structure, 18: 16013
NH_4F–EuF_3, chemical properties and crystal structure, 18: 16013
NH_4F–GdF_3, chemical properties and crystal structure, 18: 16013
NH_4F–HoF_3, chemical properties and crystal structure, 18: 16013
NH_4F–LaF_3, chemical properties and crystal structure, 18: 16013
NH_4F–NdF_3, chemical properties and crystal structure, 18: 16013
NH_4F–SmF_3, chemical properties and crystal structure, 18: 16013
NH_4F–YbF_3, chemical properties and crystal structure, 18: 16013
AMMONIUM URANATES
thermal decomposition of poly-, 18: 16007(T) (AEC-tr-6377)
AMMONIUM URANYL SULFATES
preparation of granular spheres of, with uniform particle size, 18: 16065(P)
ANALYSIS
of irradiated and unirradiated reactor fuels, literature review, 18: 15960 (SGAE-PH/CH-1/1964)
ANEMIA
effects of fetal liver implants on, in mice, 18: 15743(R) (LAMS-3034 (p.279-85))
radiation effects on Japanese mortality from, from atomic bomb, 18: 15875
ANIMAL CELLS
electronic measurement of volumes of, 18: 15739(R) (LAMS-3034(p.235-52))
radiation effects on sarcoma in tissue culture, deuteron, 18: 15829
radiation effects on enzyme activity in extracts of tissue cultures of, 18: 15831
radiation effects on DNA synthesis in, in tissue culture, effects of virus infection on, 18: 15835
radiation effects on subcellular responses in, 18: 15864
radiation effects on, refutation of hit theory for, 18: 15865
radiation effects on mammalian, protective effects of natural substances against, 18: 15897
radioinduced mitotic delay in dog erythroblast, x, 18: 15874
tritiated thymidine uptake by HeLa, 18: 15802
ANIMAL REPRODUCTION
radiation effects on rats in relation to, 18: 15760
radiation effects on, in mice, 18: 15809(R) (LAMS-3034(p.124-8))
radiation effects on rabbit, Freedman reaction in, beta, 18: 15821
ANIMALS
effects of Malathion on, of forest ecosystem, 18: 17362(R) (TID-20355)
macroscopic benthic, survey of Cape Cod, 18: 17363 (TID-20363)
radiation effects on nucleo-cytoplasmic interrelations in, during embryonic development, 18: 15867
radiation scanning system for, design of, 18: 15763 (ACRH-20(p.136-43))
radioactivity retention in, in use of labeled drugs, 18: 15784 (TID-7689(p.58-62))
ANION EXCHANGE MATERIALS
sorptive properties of aminoethylcellulose, DEAE, and resin papers for metal ions, 18: 16139
ANNEALING
effects of radiation, thermal, and uv, on neutron irradiated ammonium and potassium dichromates, 18: 16114
effects of thermal and uv, on Szilard-Chalmers reactions in ammonium, potassium, and tetramethyl ammonium dichromates, 18: 16115
ANTIBODIES
immune response of hyperimmune rat spleen cells to bovine serum albumin, 18: 15855
radiation effects on hemagglutination-inhibiting production in influenza-immune rats, beta and gamma, 18: 15820
radiation effects on production of, in rabbits after neonatal injection of, bovine blood serum albumin, 18: 15857

radiation effects on formation of, in rabbits, 18: 15881
transfer of, in guinea pigs, 18: 15825

ANTIGENS
radiation effects on immune response of hyperimmune spleen cells of rats to bovine serum albumin, 18: 15855
radiation effects on response of rabbits to neonatal injections of bovine blood serum albumin, 18: 15857

ANTIMONY
determination in petroleum and its products, activation, 18: 15968
separation from irradiated enriched tellurium, radiochemical, 18: 16149
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139

ANTIMONY ALLOYS
Sb–In, neutron diffraction in crystals, 18: 16510
Sb–In, response to infrared radiation, 18: 17103 (ARL-64-6)

ANTIMONY ISOTOPES Sb-124
beta decay scheme of, angular correlations in, 18: 17015
preparation and properties of, for use as neutron sources, 18: 16379
separation from fission products by amalgam exchange, radiochemical, 18: 16148

ANTINEUTRINOS
interactions with protons, use of 1000-Bev accelerator to study, 18: 16750 (BNL-7534(p.88-106))
interactions with protons, cross section for absorption, 18: 16760 (LAMS-3013)

ANTIPROTONS
interactions with protons, feasibility of using 600- to 1000-Bev accelerators to study elastic, 18: 16749 (BNL-7534(p.83-7))
interactions with protons, colliding-beam technique for possible boson (W) production in, 18: 16752 (BNL-7534(p.308-11))
interactions with protons, forward scattering amplitude in, 18: 16787

APHOLATE
mutagenic and toxic effects on *Neurospora crassa*, 18: 15868

ARGON
deuterium and hydrogen rearrangement collisions at high energies, 18: 16676
dielectric constant of afterglow plasma in, 18: 17234
diffusion from calcium fluorides at 700 to 1300°C, 18: 16486(T,R) (EURAEC-969)
effects of InFab atmosphere on weld parameters of refractory materials, 18: 16450(R) (AD-431672)
electric conductivity between electrodes in shock-heated, 18: 17222
electric discharge in, pinch dynamics of sinusoidally time-dependent currents in, 18: 17160
electron capture by, excitation by, 18: 16709
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ionization by electron impact, 18: 16720
ionization by fission products, 18: 16740(R) (AD-425231)
ionization of, Auger effect in, 18: 16698
photon absorption by, cross sections for, 18: 16717
plasma of, collimated thermopile for probing arcjet, 18: 17138
plasma of, effects of sulfur hexafluoride seeding on supersonic streams, 18: 17176
plasma of, electromagnetic wave whistler-mode propagation in afterglow in magnetic field, 18: 17187
plasma of, interferometric analysis of flow of shock-arc-heated, 18: 17175
plasma of, production in rail-type gun, 18: 17131
plasma of, radiative heat transfer from shock-heated, 18: 17173
plasma of, supersonic flow gas properties of, 18: 17145
potassium atomic beam scattering by, 18: 17121(R) (TID-20362)
properties of plasma of, 18: 17212
reactions of atoms and ions of, energy losses in, 18: 16710
stability of clathrate compound with hydroquinone, radiation and thermal, 18: 16084

ARGON IONS
ionization cross sections of, calculation of, 18: 16661
reactions with deuterium and hydrogen molecules at high energies, rearrangement, 18: 16676
scattering by metals, large-angle, 18: 16667
sputtering on copper, focusing model for, 18: 16672
sputtering on copper at 20 kev, temperature dependence of, 18: 16673
stripping processes at 100 to 450 kev, cross sections for, 18: 16712
van der Waals radii of, relation of hydration energy to, 18: 16016

ARGON ISOTOPES Ar-40
alpha reactions (α,d) with, $(d_{5/2})^1$ and $(f_{7/2})^1$ levels from, 18: 16933 (ANL-6848(p.182-7))
proton reaction (p,γ), angular distribution and spectra from, 18: 16945 (NP-13601)

ARGON ISOTOPES Ar-42
production in iron by 730 Mev protons, cross sections for, 18: 17049

ARGON SYSTEMS
Ar–Cs, radiation losses by cesium-seeded plasma of, 18: 17105 (BSD-TDR-64-6)
Ar–N_2, ionization by electron impact, 18: 16720

ARGONNE SYNCHROTRON
particle detection in, review of equipment for sub-nuclear, 18: 16326
research program for, 18: 16619

ARMY REACTORS
fuel element shipping for, hazards evaluation of cask for, 18: 16225 (MND-M-1856)

ARMY REACTORS (ML-1)
operation tests, 18: 17313

ARMY REACTORS (PM-1)
fuel element shipping for, hazards evaluation of cask for, 18: 16225 (MND-M-1856)
handling and transportation tests, 18: 17299 (MND-M-1915)

ARMY REACTORS (SL-1)
pressure vessel notch ductility, 18: 16527(R) (NRL-Memo-1393)

ARMY REACTORS (SM-1)
neutron flux distribution in, estimation of pressure vessel embrittlement from, 18: 16527(R) (NRL-Memo-1393)

ARSENIC
determination in biological and organic materials, activation, 18: 15971
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656

ARSENIC ISOTOPES As-75
neutron reactions (n,α) at 14 Mev, 18: 17057

ARSENIC ISOTOPES As-76
beta decay scheme of, nuclear parameters for, 18: 17012
preparation and properties of, for use as neutron sources, 18: 16379

ARSENIC SYSTEMS
As–Pu, preparation, 18: 17351(R) (BMI-1659(Del.))
AsSeTe, radiation effects on electric conductivity of, 18: 16541
AsSeTl, radiation effects on electric conductivity of, 18: 16541

ASPHALT
analysis for trace metals, activation, 18: 15968

ASTROPHYSICS
electrodynamics in, cosmic, 18: 17122(T) (NASA-TT-F-175)
intensity fluctuations in radio astronomy, relation of fluctuations in nuclear reaction cross sections to, 18: 16637
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580
source of energy for radio galaxies, 18: 16636

ATLANTIC OCEAN
macroscopic benthic fauna off Cape Cod, 18: 17363 (TID-20363)

ATMOSPHERE
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
beryllium contamination of, at production facilities, sampling methods for measuring, 18: 16236
effects on cosmic radiation, 18: 16735
fallout monitoring in Canada, 18: 16229 (NP-13760)
fission product motion in, from high-altitude nuclear explosion, 18: 16213
model for upper, 18: 16850
radioactivity at altitudes above 60,000 ft at San Angelo, Texas and Mildura, Australia, July to September 1963, 18: 16203(R) (NYO-10496)
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580

ATOMIC BEAMS
plasma diagnostics with, research progress on, 18: 17121(R) (TID-20362)
preparation of hydrogen, 18: 16703
production of hydrogen, in 2S state, cross sections for, 18: 16704

ATOMIC ENERGY
book: *Summary of Nuclear Energy*, 18: 17375

ATOMIC EXPLOSIONS
fallout from, effects of radionuclide fractionation on exposure dose rates from local, 18: 16234 (USNRDL-TR-715)
fission product motion from high-altitude, 18: 16213
ionospheric effects of high-yield, low-altitude, 18: 16859
meteorological effects of 1962 Christmas Island, 18: 16546 (AWRE-O-87/63)
seismic data for CLEARWATER event, long-range, 18: 16189 (AD-427125(Rev.))
seismic data for SHOAL event, local, 18: 16190 (NP-13757)
seismic data from STONES event, long-range, 18: 16191 (NP-13586(Rev.))
use in excavations, 18: 16162 (UCRL-7657)
use to construct sea-level transisthmian canal, 18: 16161 (SC-4929(RR))
ATOMIC PHYSICS
conference on ionization phenomena in gases, Paris, July 8-13, 1963, Vol. I, 18: 16689
density matrix based on path integrals, 18: 16652(T) (UCRL-Trans-1026(L))
electron transitions, intensities in vibrational structure of, 18: 16651 (UCRL-10925)
research program on, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
ATOMIC WEAPONS
effects on mortality in Hiroshima and Nagasaki, 18: 15875
human survival of, review, 18: 15859
ATOMS
collisions of, coulomb effects on cross sections for inelastic, 18: 16711
collisions of, energy losses in single, 18: 16710
correlation functions for two-electron, exponential, 18: 16655
electric field of, eigenfunctions for, 18: 16658
electron spin-orbit coupling constants for 4d and 4f shell, 18: 16664
Hartree-Fock potential of neutral, analytical expressions for, 18: 16656
interactions of two-electron, delta-function model for, 18: 16657
production of excited neutral, by charge exchange, 18: 17118 (NP-13744)
three-body electron-electron-ion recombination rate for continuous distribution of energy levels in, 18: 16726
velocity distribution in molecular beams, time-of-flight measurement of, 18: 16653(T) (UCRL-Trans-1032)
wave functions for, perturbation calculations of degenerate, 18: 16800
ATROPINE
carbon-14-labeled, synthesis of, 18: 16069
AURORAL STORMS
cosmic-particle effects on polar, 18: 16871
electric currents in ionosphere and earth during, 18: 16860
geomagnetic symmetries in, at high latitudes, 18: 16869
latitude minimum of quiet arcs during geomagnetic storms, 18: 16821
properties of radio aurorae at high latitudes, 18: 16861
radio-wave multiple scattering in ionosphere during, 18: 16875
ray structure observation over College, Alaska, 18: 16820
AUSTRALIA
fallout monitoring at Mildura by high-altitude balloon flights, July to September 1963, 18: 16203(R) (NYO-10496)
radium-226 content of coal and surface waters in, 18: 16211
AUTORADIOGRAPHY
beta self-absorption in tritium, 18: 15928
of paper chromatograms, use of, in radiometric analysis of urine, 18: 15989
techniques for tritium-containing chromatograms, evaluation of, 18: 15984
use in radiation effects studies on rat lymphocytes, 18: 15872
2H-AZEPIN-2-ONE, HEXAHYDRO-
radiation effects on ESR spectra of single crystals of, 18: 16090

B

BACTERIA
radiation effects on viability of tubercle bacilli, 18: 15824
radiation effects on dehydrogenases and transaminases in *B. subtilis*, x, 18: 15845
radiation effects on *Salmonella typhimurium*, gamma, 18: 15854
radiation effects on enzyme synthesis in Pseudomonas, x, 18: 15871
separation of desoxyribonucleic acid from, 18: 15776(R) (LAMS-3034 (p.288-95))
BACTERIOPHAGES
dark reactivation of ultraviolet-irradiated desoxyribonucleic acid from, 18: 15832
radiation effects on, protective effects of nitric oxide against x, 18: 15901
separation of desoxyribonucleic acid from, 18: 15777(R) (LAMS-3034 (p.296-302))
BARIUM
determination of, uses of radioactive tracers in, 18: 15962 (TID-7689(p.81-5))
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
plasma of, ion density measurement by resonance light scattering in, 18: 17168
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation using α-hydroxyisobutyric acid, chromatographic, 18: 16142
solvent properties in D2EHPA hydrochloric acid, 18: 16147
BARIUM ALLOYS
Ba–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
BARIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
BARIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BARIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BARIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
heat of sublimation, 18: 16006 (UCRL-11124)
vapor pressure at 1260 to 1550°K, 18: 16006 (UCRL-11124)
BARIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BARIUM IONS
density in plasma, measurement by resonance light scattering, 18: 17168
van der Waals radii of, relation of hydration energy to, 18: 16016
BARIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
BARIUM ISOTOPES Ba-133
uptake by embryonic chick and rat bones, 18: 15803
BARIUM ISOTOPES Ba-140
content in foodstuffs in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
separation from fission products by amalgam exchange, radiochemical, 18: 16148
BARIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
BARIUM TITANATES
ferroelectric domains in single crystals of, electron microscopic observation of, 18: 16556
BARLEY
nucleic acid synthesis in seeds of, 18: 17361(R) (TID-20353)
radiosterilization of malt of, 18: 15840
BARYONS
properties of resonance, review, 18: 16770
BECQUERELITES
synthesis, 18: 16009
BEHAVIOR
of man, prediction of human error rates in man-machine system, 18: 17358 (SC-R-685)
of plants to light, biochemical effects, 18: 17365(T) (AEC-tr-6362)
of rats, effects of brain serotonin content on, 18: 17364 (UCRL-11179)
radiation and age effects on response to training in monkeys, 18: 15850
radiation effects on response to stimulus of monkeys, 18: 15849
radiation effects on response to stimulus of monkeys, 18: 15851
radiation effects on response to stimulus of monkeys, 18: 15852
radiation effects on learning performance of monkeys, 18: 15853

BELGIAN REACTOR-2
operation, 18: 17303(T) (NP-tr-1121)
operation, 18: 17304(T) (NP-tr-1122)
BENZENE, CHLORONITRO-
spectra of, effects of metal ions on nuclear hyperfine coupling constants in EPR, 18: 16068
BENZENE, DICHLORO-
chlorine nuclear quadrupole resonance in para, relaxation time for, 18: 16041
BENZENES, ALKYL-
deuteration of, mechanisms of π-complexes in catalytic, 18: 16040
BENZOIC ACID, p-AMINO-
radiation effects on solutions of, x, 18: 16110
BENZOPHENONES
radiosensitivity effects on mineral oils, 18: 16127(P)
BERKELIUM
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
BERKELIUM COMPOUNDS
properties of, review of, 18: 16051
BERYLLIUM
atmospheric contamination by, at production facilities, sampling methods for measuring, 18: 16236
concentration in low-grade beryl ores, flotation process for, 18: 16154(P)
corrosion by carbon dioxide at 450 to 825°C, 18: 16444
corrosion resistance and mechanical properties, effects of titanium and zirconium on, 18: 16448(P)
determination in oilfield waters using acetylacetone and chloroform, spectrometric, 18: 15967
electric dipole and quadrupole polarizabilities and shielding factors of atomic, second-order perturbation theory of, 18: 16801
energies and wavefunctions for lowest ^1S states of, exponential correlation functions for, 18: 16655
extrusion to fine wires, 18: 16451(R) (AD-432273)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
Knight shift in, 18: 16515
neutron inelastic cross sections on, at 14.2 Mev, 18: 16966
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
BERYLLIUM ALLOYS
Be–Fe, extrusion to fine wires, 18: 16451(R) (AD-432273)
Be–Pu, phase diagram of, 18: 16493
Be–Ti, corrosion resistance to carbon dioxide and mechanical properties, 18: 16448(P)
Be–U, preparation, 18: 16049
Be–Zr, corrosion resistance to carbon dioxide and mechanical properties, 18: 16448(P)
BERYLLIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BERYLLIUM BRONZE
tensile properties of, effects of heat treatment and plastic deformation on anisotropy of, 18: 16497
BERYLLIUM CARBIDES
melting temperature, evaluation for space technology, 18: 16521
BERYLLIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BERYLLIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BERYLLIUM HYDRIDES
bonding in, discontinuous change of, 18: 16028
BERYLLIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
BERYLLIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
BERYLLIUM ISOTOPES
properties of hyperfragments of, review, 18: 16963
BERYLLIUM ISOTOPES Be-7
gamma spectra of, 18: 17006
metabolism in rats, 18: 15769(R) (LAMS-3034(p.59-64))
BERYLLIUM ISOTOPES Be-8
decay scheme for, in 16.6- and 16.9-Mev states, 18: 17022
energy levels around 23 Mev, properties of, 18: 17023
BERYLLIUM ISOTOPES Be-9
deuteron reactions (d,pγ) with, angular correlations from, 18: 16993
deuteron reactions (d,n), model for, 18: 17053
electron fission of, cross sections for, 18: 17024
gamma emission from, produced by lithium-7 (He-3,p) at 14.4 Mev, 18: 17101
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
lithium-6 reactions with, excited final states from, 18: 17005
proton inelastic scattering by, excited states from, 18: 17070
BERYLLIUM ISOTOPES Be-10
production in carbon, nitrogen, and oxygen by 220-Mev protons, cross sections for, 18: 17049
production in iron by 730 Mev protons, cross sections for, 18: 17049
BERYLLIUM OXIDES
corrosion by carbon dioxide at 450 to 825°C, 18: 16444
determination of airborne particulate, 18: 16271(P)
diffusion of iodine and rare gases in, 18: 16424(R) (GEMP-270A)
melting temperature, evaluation for space technology, 18: 16521
production of high-purity single-crystal fiberts and platelets of, 18: 16435(P)
properties as fuel particle coatings, 18: 17351(R) (BMI-1659(Del.))
radiation effects on properties and structure of, 18: 16424(R) (GEMP-270A)
thermal conductivity of foams of, for use above 3000°F, 18: 16520
Be–BeO, extrusion to fine wires, 18: 16451(R) (AD-432273)
BERYLLIUM SYSTEMS
Be–BeO, extrusion to fine wires, 18: 16451(R) (AD-432273)
BERYLS
concentration of beryllium in low-grade, flotation process for, 18: 16154(P)
BESSEL FUNCTIONS
infinite sums involving zeros of $J_0(x)$, evaluation of, 18: 16418
BETA DECAY
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in Russian, 18: 17096
theory, 18: 16760 (LAMS-3013)
BETA PARTICLES
detection and measurement of, book on high-sensitivity, 18: 16354
dosimetry, problems in personnel, 18: 16364
effects on moth eyes, 18: 15814 (USNRDL-TR-698)
effects on rat hemagglutination-inhibiting antibody production, 18: 15820
measurement in water, reliability of, 18: 15979
scattering by elements, compiling data on excitation spectra from, 18: 16650 (TID-7689(p.80-1))
self-absorption in tritium radioautography, 18: 15928
transmutation efficiency in Saccharomyces, 18: 15870
BETA SHIELDING
book: *Problems in Dosimetry and Shielding*, 18: 17246
BETA SOURCES
development of phosphorus-32 chromic phosphate, for implantation irradiation of urethra, 18: 15935
BETA SPECTROMETERS
description of double-focusing electrostatic, 18: 16325
design of Cherenkov, 18: 16330
design of magnetic, 18: 16332
design of scintillation, 18: 16347
performance in external-conversion gamma spectrometers, 18: 16320
resolution correction for, 18: 16306 (SGAE-PH-3/1964)
BETATRONS
beam injection into phase space of, two equilibrium orbits method for, 18: 16601 (BNL-7534(p.414-16))
bremsstrahlung production in, device for determining beam center of 25 to 30 Mev, 18: 16350
electron capture without oscillations in, mechanism of, 18: 16622
particle acceleration in, with toroidal magnetic field, 18: 16621
radiation from, electron component of, 18: 16625

synchronization with synchrotron, 18: 16624
BEVERAGES
analysis for phosphorus and sulfur in beer, activation, 18: 15970
BIBLIOGRAPHIES
on analysis of irradiated and unirradiated reactor fuels, 18: 15960 (SGAE-PH/CH-1/1964)
on analytical methods for alkali metals, 18: 15964 (WCAP-2540)
on group constants for fast and intermediate neutrons, 18: 17287 (NP-13666)
on Homogeneous Reactor Test design, 18: 17326 (ORNL-TM-348)
on insects and insecticides, 18: 15756
on Lawrence Radiation Laboratory mechanical engineering notes and specifications, 18: 16160 (UCRL-11200(Vol.1))
on melting points of metal oxides, 18: 15996 (NBS-MON-68)
on methods for production of iodine-131, phosphorus-32, and sulfur-35, 18: 16398 (JAERI-4027)
on movement of radioisotopes in earth environment, 18: 16207
on plasma electrodynamics in space, 18: 17122(T) (NASA-TT-F-175)
on plutonium technology, 18: 17353 (HW-68600-35)
on polonium, 18: 15946(T) (MLM-1165(Tr))
on properties of refractory metal borides and nitrides, 18: 16481 (UCRL-7559)
on pulmonary deposition and retention of aerosols, 18: 15806
on radiation effects on uranium-based reactor fuel materials, 18: 16529 (VDIT-16(4.1))
on radioactivity of marine organisms in sea water, 18: 17335 (NP-13756 (Vol.II))
on reactor fuel dispersions, 18: 17289 (CEA-Bib-41)
on solar wind, 18: 16629 (AD-430410)
on technetium, 18: 15947
BILLIETITES
synthesis, 18: 16009
BIOLOGICAL MATERIALS
analysis for arsenic and mercury simultaneously, activation, 18: 15971
analysis for carbon-14 and tritium by flask combustion, method for, 18: 15973
analysis of marine, for strontium-90 content, 18: 15758(R) (TID-20347)
BIOLOGICAL SYSTEMS
processes in, possibilities of erroneous conclusions from tracer studies of, 18: 15784 (TID-7689(p.58-62))
BIOLOGY
marine ecology and life cycle studies using radioisotopes, 18: 15748 (TID-7689(p.69-72))
radiation dosimetry of personnel in relation to, 18: 16264
BIOMETRY
method for prediction of human error rates in man-machine system, 18: 17358 (SC-R-685)
BIOTITES
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
BIPHENYL
properties for use as coolant in Orgel Reactor, 18: 17307
BISMUTH
determination in bismuth-tin alloys, intensity ratio technique for x-ray spectrometric, 18: 15972
electric conductivity of, effects of magnetic field and temperature on, 18: 16660
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
proton fission at 156 Mev, cross sections and distributions from, 18: 17004
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
viscosity of liquid, 18: 16153
BISMUTH ALLOYS
Bi–Cd, radiation effects on contact melting of, 18: 16538
Bi–Sn, intensity ratio technique for x-ray spectrometric analysis for bismuth and tin in, 18: 15972
Bi–Sn, radiation effects on contact melting of, 18: 16538
BISMUTH ISOTOPES Bi-209
deuteron reactions (d,p) with, potential range and polarization effects in, 18: 16911 (ANL-6848(p.43-50))
proton reactions with, nucleon cascades from, 18: 16974
BISMUTH ISOTOPES Bi-210
separation from fission products by amalgam exchange, radiochemical, 18: 16148
BLAST EFFECTS
on reactor containment vessel models, internal, 18: 17258 (BRL-Memo-1530)
on rectangular plates, calculation of inertial load in, 18: 17359 (SCL-TM-64-34)
BLOOD
calcium-47 uptake by dog, effects of adrenal steroids on, 18: 15796
radiation effects on, protective effects of adenine against, 18: 15902
BLOOD CELLS
radiation dosimetry using, 18: 16259
sample preparation for chromosome analysis of monkey, 18: 15738(R) (LAMS-3034(p.227-34))
BLOOD PICTURE
Macaca mulatta and *M. speciosa* monkeys, 18: 15773(R) (LAMS-3034 (p.96-102))
BLOOD SERUM
chromium-51-labeled albumins in, stability of, 18: 15793
radiation effects on potassium and sodium content in rats, x, 18: 15842
radiation effects on liproproteic fractions of, in rabbits, 18: 15879
transfer of antibodies by, 18: 15825
BLOOD TRANSFUSIONS
effects on erythropoiesis in mice, 18: 15833
BLOOD VESSELS
brain barrier changes in, tracer studies of, 18: 15746 (TID-7689(p.50-1))
microscopy, sample preparation for demonstration of lipid component, 18: 17373(T) (UCRL-Trans-1033)
radiation effects on response of, to hemorrhagic stress in dogs, 18: 15886
BODY WATER
volume and turnover of, in monkeys, 18: 15772(R) (LAMS-3034(p.76-80))
BOILING
burnout heat flux for water, equipment and techniques for measuring, 18: 16184(T,R) (EURAEC-883)
critical heat flux in steam–water mixtures flowing in vertical tubes, 18: 16172 (EURAEC-951)
critical heat flux in water, effects of induced whorls on, 18: 16183(T) (EURAEC-639)
heat transfer in steam–water mixtures flowing in heated tube, 18: 16171 (EURAEC-929)
hydrodynamic instabilities in channel, model studies of, 18: 16180(T) (AEC-tr-6364)
BOILING REACTORS
core performance in, effects of twisted tapes on, 18: 17251(T) (EURAEC-931)
BONE DISEASES
radioinduced osteomyelitis of jaws, after radiotherapy of oral cancer, 18: 15860
BONE MARROW
chromosome number in, from normal and leukemic mice, 18: 15744(R) (LAMS-3034(p.307-11))
distribution of, as factor in estimating radiation to hematopoietic system, 18: 15847
morphology of chromosomes in mouse, effects of ancestral irradiation on, 18: 15812(R) (LAMS-3034(p.303-6))
radiation effects on iron-59 metabolism during erythropoiesis in mouse, 18: 15833
radioinduced mitotic delay in dog, x, 18: 15874
radiosensitivity effects in urethan-treated mice of isologous, 18: 15899
BONE TUMORS
localization of metastatic, by scanning after administration of strontium-85, 18: 15932
radioinduced in dogs after injection of plutonium-239, 18: 15817(T) (FTD-TT-63-559(p.150-72))
BONES
barium-133 and calcium-45 uptake by embryonic chick and rat, 18: 15803
calcium-47 uptake by dog, effects of adrenal steroids on, 18: 15796

calcium, strontium, and strontium-90 concentrations in brown trout, 18: 16243
cesium-137 and potassium-40 content of, effect of ashing temperature on, 18: 15953(R) (LAMS-3034(p.201-4))
iron-59 uptake by rat tibia, effects of erythropoietin on, 18: 15797
strontium-90 uptake from milk, 18: 15796

BORIDES
bibliography on properties of refractory, 18: 16481 (UCRL-7559)

BORON
determination in silicon, neutron-reaction, 18: 15993
diffusion in boron carbide–uranium dioxide systems to 2200°C, 18: 16468(R) (CEND-203)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656

BORON CARBIDES
fabrication and properties of boron-10-enriched and -depleted, 18: 16427 (WAPD-244)
melting temperature, evaluation for space technology, 18: 16521
properties as burnable poison addition to uranium dioxide, 18: 16468(R) (CEND-203)
reactions with uranium dioxide in flowing argon to 2200°C, effects of tungsten additions on, 18: 16468(R) (CEND-203)
B_4C–SiC, corrosion by water at 680°C, 18: 16427 (WAPD-244)
B_4C–SiC, fabrication, 18: 16427 (WAPD-244)
B_4C–UO_2, thermodynamic properties to 2200°C, 18: 16468(R) (CEND-203)

BORON FLUORIDES
sensitivity in neutron detectors, 18: 16891(R) (GA-4881)

BORON HYDRIDES
bonding in, discontinuous change of, 18: 16028

BORON ISOTOPES
properties of hyperfragments of, review, 18: 16963

BORON ISOTOPES B-10
gamma spectra of, 18: 17006
lithium-6 reactions with, excited states from, 18: 17007
proton inelastic scattering by, excited states from, 18: 17070
proton reactions (p,d) with, mechanisms for, 18: 17043

BORON ISOTOPES B-11
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
proton inelastic scattering by, excited states from, 18: 17070
proton reactions (p,d) with, mechanisms for, 18: 17043

BOSONS
decay of vector, neutrino-pair, 18: 16759 (CERN-64-13(Vol.III) (p.81-110))
energy of imperfect gas of, ground-state, 18: 16811
field operators for, 18: 16804
production of intermediate (W), use of proton colliding beams to study possible, 18: 16752 (BNL-7534(p.308-11))

BRAIN
blood barrier changes in, tracer studies of, 18: 15746 (TID-7689(p.50-1))
development in rats, comparison of effects of nitrogen mustard and x rays on, 18: 15834
radiation effects on cat, relation to craniocerebral injury, x, 18: 15818(T) (JPRS-23544)
radiation effects on, of mice, 18: 15830
serotonin content of rat, behavior effects of, 18: 17364 (UCRL-11179)

BRAIN TUMORS
localization by positron scanning after administration of iodine-124-labeled gamma globulin, 18: 15933
localization by scanning after administration of gallium-68, 18: 15931
localization of, using technetium-99m, 18: 15913 (TID-7689(p.1-11))
radioisotopic encephalography for diagnosis of, 18: 15937

BRASS
stability of, effects of thermal cycling on, 18: 16492
Al–brass, stability of, effects of thermal cycling on, 18: 16492

BREEDER REACTORS
economic evaluation of, long-term, 18: 17306
fission product retention in thorium, effects of, 18: 17302 (UCRL-7544)

BREMSSTRAHLUNG
emission by hot plasma, 18: 17103 (ARL-64-6)
emission in electron reactions with silver foils, 18: 16649 (ORNL-3485)
production in betatrons, device for determining beam center of 25 to 30 Mev, 18: 16350
scattering by nuclei, giant resonance effects on elastic, 18: 17040

BREMSSTRAHLUNG SHIELDING
book: *Problems in Dosimetry and Shielding*, 18: 17246

BRICKS
gamma attenuation by burnt, 18: 17245

BROMINE
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neon-20 reactions in emulsion with, models for, 18: 17010

BROMINE IONS
van der Waals radii of, relation of hydration energy to, 18: 16016

BROMINE ISOTOPES Br-79
neutron reactions (n,α) at 14 Mev, 18: 17057

BROMINE ISOTOPES Br-81
nuclear magnetic resonance spectra in potassium bromide, silver bromide, and sodium bromide, gradient-elastic tensor from quadrupole broadening in, 18: 16562

BROOKHAVEN ALTERNATING-GRADIENT SYNCHROTRON
beam intensity increase in, feasibility of, 18: 16596 (BNL-7534 (p.379-84))
experimental programs for, 18: 16584 (BNL-7534(p.39-48))
proton storage in, initial tests of, 18: 16589 (BNL-7534(p.230-5))

BROOKHAVEN SYNCHROTRON
beam decay in, mechanisms of coasting, 18: 16588 (BNL-7534(p.228-9))

BUBBLE CHAMBERS
design of heavy-liquid, for high-energy experiments, 18: 16293 (BNL-7534(p.107-12))
development and operation, 18: 16552(R) (UCRL-11132)
particle tracks in, equipment for measuring, 18: 16336
photographs of, kinematical analysis of, 18: 16296 (CERN-64-13(Vol.I) (p.87-129))
use for detecting sub-nuclear particles in the ZGS, 18: 16326
use of heavy-liquid, at high-energy accelerators, 18: 16294 (BNL-7534 (p.113-27))

BUBBLES
motion in fluidized solid beds, 18: 16181(T) (AERE-Trans-997)

BUTYL PHOSPHATES
deterioration of TBP, in solvent-extraction processes for irradiated fuels, 18: 16152
radiation effects, 18: 16143
solvent properties for ruthenium from nitric acid, 18: 16377(R) (ORNL-TM-515)
solvent properties for group IVA, VA, and rare earth elements, 18: 16157(P)
use of, in liquid scintillation, 18: 16375(P)
kerosene–TBP, analysis for nitric acid and uranium by potentiometric titration, 18: 15966

C

CADARACHE REACTORS (RAPSODIE)
fuel element development for, 18: 17290(T) (AEC-tr-6359)

CADMIUM
determination of traces of, in uranium metal, spectrographic, 18: 15950 (EUR-587.e)
determination of, design of atomic absorption spectrophotometer for, 18: 16281
diffusion in liquid cadmium–lead alloys, tracer study of, 18: 16480 (TID-20326)
heat capacities at low temperatures, measurement of, 18: 16886
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139

CADMIUM ALLOYS
Bi–Cd, radiation effects on contact melting of, 18: 16538
Cd–Pb, diffusion of cadmium and lead in liquid, 18: 16480 (TID-20326)
Cd–Sn, radiation effects on contact melting of, 18: 16538
Cd–Zn, radiation effects on contact melting of, 18: 16538

CADMIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
CADMIUM ISOTOPES Cd-110
energy levels, 18: 17051
energy levels, 18: 16954 (UCRL-11143)
CADMIUM ISOTOPES Cd-111
energy levels and gamma spectra of, 18: 17018
CADMIUM ISOTOPES Cd-115
decay of metastable, 18: 17056
separation from fission products by amalgam exchange, radiochemical, 18: 16148
CADMIUM SULFIDES
radiation effects on structure of, 18: 16125
CALCITES
sorptive properties with phosphate for strontium-90, kinetics of, 18: 17343
CALCIUM
determination in biological samples, soils, and waters, flame spectrophotometric, 18: 15957 (RT/PROT(63)-13)
determination of, uses of radioactive tracers in, 18: 15962 (TID-7689(p.81-5))
deuteron elastic scattering by, nuclear tensor potentials from, 18: 17041
effects on strontium-90 movement and sorption by clay soils, 18: 16208
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ion exchange in soils, 18: 17342
ionization of, Auger effect in, 18: 16698
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
separation from magnesium and strontium by anion exchange, 18: 16132
separation using α-hydroxyisobutyric acid, chromatographic, 18: 16142
sorption by ploughed soils, 18: 16217
uptake by banana leaf disks, effects of light on, 18: 15798
uptake by brown trout, 18: 16243
CALCIUM ALLOYS
Ca–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Ca–Zn, solvent properties for plutonium and uranium, 18: 16153
CALCIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
CALCIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CALCIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
$CaCl_2$–NaCl, solvent properties for niobium, 18: 16032
CALCIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
diffusion of argon from, at 700 to 1300°C, 18: 16486(T,R) (EURAEC-969)
thermoluminescence of electron-irradiated yttrium-doped, 18: 16557
CALCIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CALCIUM IONS
use for exchange in clay mineral studies, comparison with magnesium and strontium, 18: 16200
van der Waals radii of, relation of hydration energy to, 18: 16016
CALCIUM ISOTOPES Ca-40
alpha inelastic scattering by, particle-hole analysis of, 18: 16919 (ANL-6848(p.108-13))
alpha reactions (α,d) with, $(d_{5/2})^1$ and $(f_{7/2})^1$ levels from, 18: 16933 (ANL-6848(p.182-7))
deuteron reactions (d,pγ) with, angular correlations from, 18: 16993
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
deuteron scattering by, distributions from polarized, 18: 16617
electromagnetic monopole transitions in, partial widths for 2γ, 18: 16999
proton inelastic scattering by, excited states from, 18: 17042
proton inelastic scattering by, excited states from, 18: 17070
proton reactions (p,d) with, mechanisms for, 18: 17043
CALCIUM ISOTOPES Ca-45
transfer by root systems in hardwood forest, 18: 15757 (TID-7689(p.62-5))
uptake by embryonic chick and rat bones, 18: 15803
CALCIUM ISOTOPES Ca-47
distribution and kinetics in dogs, effects of steroids on, 18: 15795
CALCIUM ISOTOPES Ca-49
preparation and properties of, for use as neutron sources, 18: 16379
CALCIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
Al_2O_3–CaO–MgO–ZrO_2, phase studies on, 18: 16490
CaO–Y_2O_3–ZrO_2, ionic conductivity of cubic solid solutions in, 18: 16014
CALCIUM SCANDATES
preparation and structure, 18: 16015
CALCIUM ZIRCONATES
melting temperature, evaluation for space technology, 18: 16521
CALDER HALL REACTORS
pressure vessel clean conditioning at Dungeness, 18: 17264
CALIFORNIUM ISOTOPES Cf-252
determination of, nondestructive method for, 18: 15969
fission of, energy distributions from spontaneous, 18: 17100
CALORIMETERS
calibration and performance analysis of gamma-source, 18: 16377(R) (ORNL-TM-515)
design and operation of isothermal solution, 18: 16276 (LA-3031)
CALORIMETRY
conference on, Russian, 18: 17369(T) (ANL-Trans-4)
CANADA
civilian defense programs in, 18: 16246
CARBAMIC ACID, ETHYL ESTER
leukemogenic effects in mice, protective effects of bone marrow against, 18: 15899
CARBON
crystal structure and thermal expansion of, 18: 16491
diffusion in uranium carbides, 18: 17351(R) (BMI-1659(Del.))
effects on high-density deuterium plasma, 18: 17179
effects on ionization and power loss in theta-pinch plasma, 18: 17167
effects on operation of potassium–sodium heat transfer system in Dounreay reactor, 18: 17310
fabrication of high-density bodies of, 18: 16464(P)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron reactions at 14 Mev, gamma spectra from, 18: 16329
production and use of cellulose, textile form, and vitreous, 18: 16429
properties as fuel particle coatings, 18: 17351(R) (BMI-1659(Del.))
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
proton reactions at 220 Mev, cross sections for beryllium-10 production in, 18: 17049
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
CARBON BLACK
effects on pore distribution of fine-grained graphite, 18: 16465 (AERE-R-3943)
CARBON DIOXIDES
corrosive effects on zirconium at 400 to 750°C, additive effects on, 18: 16439 (CEA-2393)
corrosive effects on beryllium, beryllium oxide, and steels at 450 to 825°C, 18: 16444
corrosive effects on beryllium and beryllium alloys, 18: 16448(P)
diffusion of hydrogen in, 18: 16054
electron beam collisions with, emission spectra from, 18: 16700
fixation and metabolism by plant pollen, tracer studies of, 18: 15785 (TID-7689(p.68-9))
reactions with water and zinc, preparation of methane for tritium counting by, 18: 16075
CARBON IONS
photon reactions with, 18: 16715
spectral line intensities of lithium-like, 18: 17185
CARBON ISOTOPES
properties of hyperfragments of, review, 18: 16963

CARBON ISOTOPES C-12
activation of, in mice by protons, 18: 15828
alpha inelastic scattering by, angular correlations in, 18: 16928 (ANL-6848(p.153-8))
alpha reactions (α,d) with, $(d_{5/2})_0^1$ and $(f_{7/2})_0^1$ levels from, 18: 16933 (ANL-6848(p.182-7))
alpha reactions (α,d) with, analysis of, 18: 16934 (ANL-6848(p.188-98))
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
alpha scattering by 14-Mev level, 18: 16951(R) (TID-20311)
deuteron reactions (d,p) with, distributions from polarized, 18: 16617
deuteron reactions with, excitation functions for, 18: 16991
deuteron reactions (d,p), 18: 16914 (ANL-6848(p.70-8))
deuteron reactions (d,n) with, cross sections and neutron polarization for, 18: 16908 (ANL-6848(p.16-23))
electron inelastic scattering at 200 Mev, spectra from, 18: 17028
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
helium-3 reactions at 1.8 to 5.4 Mev, differential cross sections and angular distributions for, 18: 17060
meson (π^-) absorption by, at rest in emulsion, 18: 16978
neutron inelastic scattering by, excited states from, 18: 16967
neutron inelastic scattering by, excited states from, 18: 16968
nucleon two-body forces for, shell model calculations of, 18: 17054
proton inelastic scattering by, polarization effects in, 18: 17044
proton inelastic scattering by, excited states from, 18: 17070
proton reactions (p,2p) with, cross sections near 100 Mev, 18: 17045
proton reactions (p,d) with, distorted-wave approximation for, 18: 16906 (ANL-6848(p.2-7))
triton reactions (t,d), 18: 16914 (ANL-6848(p.70-8))

CARBON ISOTOPES C-13
alpha reactions (α,n) at 12 to 22 Mev, analysis of, 18: 16937 (ANL-6848(p.226))
deuteron reactions (d,p) and (d,t), 18: 16914 (ANL-6848(p.70-8))
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
helium-3 reactions (He^3,α) at 1 and 2 Mev, angular distributions and cross sections of, 18: 16948 (NP-13732)
proton reactions (p,d), 18: 16914 (ANL-6848(p.70-8))
proton reactions (p,d), singlet di-nucleon state in, 18: 16932 (ANL-6848(p.180-1))
separation and purification of, methods development for, 18: 16376(R) (MLM-1157)

CARBON ISOTOPES C-14
determination in biological materials by flask combustion, method for, 18: 15973
deuteron reactions (d,p) and (d,t), 18: 16914 (ANL-6848(p.70-8))
half life of, mass spectrometric determination of, 18: 16961
incorporation into atropine, tropic acid, and tropine, 18: 16069
labeled thyroxine, synthesis of, 18: 16074
proton reactions (p,d), 18: 16914 (ANL-6848(p.70-8))
use in age estimation, book on, 18: 16219

CARBON MONOXIDES
reactions in gases of, cross sections and vibrational relaxation in, 18: 16679
spectra excitation by products from electric discharge in helium, 18: 16719

CARBON STEEL
radiation effects on mechanical properties, 18: 16525 (NP-13657)

CARBON TETRACHLORIDE
effects on cyclohexane radiolysis, 18: 16082

CARBONYL SULFIDE
electron beam collisions with, emission spectra from, 18: 16700

CARBONYLS
bonding in, research program on ligand effects on, 18: 17355(R) (MIT-1965-7)

CARCINOMAS
of parathyroid glands, relation to hyperparathyroidism, 18: 15750
radiotherapy of endometrial, using radium, survey on 610 cases of, 18: 15920
radiotherapy of ovarian, development of radiation nephritis after, 18: 15862
therapy using surgery and irradiation of uterine, fistula development after, 18: 15839

CARDIOGRAPHY
using iodine-131- or iodine-132-labeled albumin as tracer and gamma counting, 18: 15925

CASCADE SHOWERS
analysis of, Monte Carlo method for, 18: 16409 (CERN-64-13(Vol.I)(p.147-67))

CASTINGS
ceramic inclusions in gas-turbine-component, tracer studies of source of, 18: 16456 (TID-7689(p.119-25))

CATALASES
radiosensitivity of, effects of sugars on, 18: 15900

CATALYSTS
flow distribution in seal leg in petroleum cracking plant, tracer study of, 18: 16390 (TID-7688(p.84-90))

CATARACTS
radioinduced in rabbit, 18: 15944
radioinduced in rabbits, lens composition after, 18: 15816(T) (CEA-tr-R-1635)

CATHODES
semiconductor properties and thermionic emission of oxide, tracer studies of effects of indium on, 18: 16003 (TID-7689(p.136-7))

CATION EXCHANGE MATERIALS
radiation effects on sorptive properties of Zeolytes, 18: 16118
radiation effects on sorptive properties of, electron-beam, 18: 16117

CATIONS
collection by probe in plasma, 18: 17186
separation by reversed-phase chromatography using polymerized cellulose, 18: 16145

CATS
radiation effects on brain of, effects on craniocerebral injury, x, 18: 15818(T) (JPRS-23544)

CAVES
description and operation for examination of irradiated plutonium fuel elements, 18: 16163 (CEA-2395)
radiation monitoring in, design of halogen Geiger-Mueller tube for gamma, 18: 16312

CELLULOSES
sorptive properties for metal ions in hydrochloric acid, 18: 16139
sorptive properties of ion exchange papers of, with organic solvents for metal ions, 18: 16140
use of copolymerized, in chromatography, 18: 16145

CEMENTS
radioactive grout injection in, methods for, 18: 17346

CENTRIFUGATION
use in separation of gas mixtures, 18: 16156(P)

CENTRIFUGES
engineering drawings for zonal, 18: 16168

CERAMIC COATINGS
properties of flame-sprayed, for space technology, 18: 16521

CERIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from other fission products by sorption on silica gel, 18: 16144
separation from Purex waste solutions using Alamine-336, 18: 16377(R) (ORNL-TM-515)
separation from Purex waste ruthenium extraction phase using D2EHPA, 18: 16377(R) (ORNL-TM-515)
solvent partition in D2EHPA-mineral acids, 18: 16147
thermal expansion coefficient at low temperatures, 18: 16512

CERIUM ALLOYS
Ce–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496

CERIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505

CERIUM ISOTOPES Ce-140
half life of 2083-kev level in, 18: 16990
proton reactions with, nucleon cascades from, 18: 16974

CERIUM ISOTOPES Ce-144
migration and retention in lithosphere at NRTS, Idaho, 18: 17349

separation from fission products by amalgam exchange, radiochemical, 18: 16148
CERIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
reduction by aluminum *in vacuo*, 18: 16430
CERIUM SULFATES
radiolysis of, effects of copper sulfates on, 18: 16318
CERIUM SULFIDES
coating of articles of mono-, for oxidation resistance at high temperatures, 18: 16437(P)
CESIUM
additive effects of coatings of, on electronic work functions, 18: 16742(R) (GA-4804)
corrosive effects on refractory metals, role of oxygen in, 18: 16447
determination in biological samples, soils, and waters, flame spectrophotometric, 18: 15957 (RT/PROT(63)-13)
determination in stony meteorites, activation and mass spectrometric, 18: 15976
determination of, complexometric, 18: 15975
ion exchange in soils, 18: 17342
ionization of, fractional, 18: 17121(R) (TID-20362)
plasma of, modes of production of, 18: 17127
plasma seeding with, feed system for, 18: 17121(R) (TID-20362)
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from other fission products by sorption on silica gel, 18: 16144
solvent partition in D2EHPA hydrochloric acid, 18: 16147
sorption by clay minerals, effects of potassium on, 18: 17344
vapor effects on pressure gages at 10^{-9} torr, 18: 16277 (NASA-TN-D-2264)
vapor pressure of, correspondence with mercury, potassium, rubidium, and sodium, 18: 16035
CESIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CESIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CESIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CESIUM HYDRIDES
additive effects of coatings of, on electronic work functions, 18: 16742(R) (GA-4804)
CESIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
CESIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
CESIUM ISOTOPES Cs-132
retention of intravenously administered, in man, 18: 15764(R) (LAMS-3034(p.21-33))
CESIUM ISOTOPES Cs-134
movement in soils, Belgian studies on, 18: 17341
CESIUM ISOTOPES Cs-137
biological half life of, in man, 18: 15774(R) (LAMS-3034(p.184-6))
body burden in Nashville, Tennessee, factors influencing, 18: 16232 (TID-18603)
content in foodstuffs in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
determination in bone samples, radiometric, sample preparation for, 18: 15953(R) (LAMS-3034(p.201-4))
determination in beagle hounds, 18: 15771(R) (LAMS-3034(p.73-5))
determination in man, whole-body, 18: 16300(R) (LAMS-3034(p.143-51))
determination in residents of New Mexico, 1962 and 1963, whole-body, 18: 16224(R) (LAMS-3034(p.180-3))
distribution in tissues of mice and dogs after chronic exposure, 18: 15766(R) (LAMS-3034(p.41-8))
excretion and muscle cell retention, comparison with potassium, 18: 15783 (TID-7689(p.55-8))
excretion in mice, effects of exercise on, 18: 15765(R) (LAMS-3034 (p.34-40))
gamma spectra of, contribution of potassium-40 to, in gamma spectrometer with sodium iodide crystal, 18: 16302(R) (LAMS-3034(p.162-7))
migration in soils, contamination of food chains in, 18: 16239
monitoring in milk in Canada from fallout, 18: 16229 (NP-13760)
movement in soils, Belgian studies on, 18: 17341
separation from fission products by amalgam exchange, radiochemical, 18: 16148
sorption by ploughed soils, 18: 16217
uptake by *Liriodendron tulipifera*, 18: 15762
uptake by wheat from contaminated soil, 18: 15761
use in forest ecosystem study, 18: 15762
CESIUM OXIDES
performance as photocathode, polarization selectivity of, 18: 16346
CESIUM SYSTEMS
Ar–Cs, radiation losses by cesium-seeded plasma of, 18: 17105 (BSD-TDR-64-6)
CHARCOAL
sorptive properties for iodine-131 in aqueous solutions, 18: 16377(R) (ORNL-TM-515)
sorptive properties for iodine-131, efficiency of, 18: 16230 (TID-7688 (p.58-74))
CHARGED PARTICLE BEAMS
acceleration of, evolution of accelerators for, 18: 16613
bending for use in scanning surface, design of apparatus for, 18: 16628(P)
bending of, design of apparatus for, 18: 16627(P)
interactions of colliding, information available from, 18: 16591 (BNL-7534(p.253-76))
path from cyclotron to target chamber of, measuring probes for regulating, 18: 16618
CHARGED PARTICLES
acceleration by electromagnetic and magnetostatic field gradients, 18: 17151
acceleration in betatron with toroidal magnetic field, 18: 16621
content in low pressure discharge, measurement from H_β line broadening, 18: 16659(T)
density distribution and intensity in magnetic field, 18: 16731(T) (FTD-TT-64-90(p.110-27))
diffusion from plasma decay in magnetic field, 18: 17227
effects of, measurement and shielding, 18: 17375
energy losses in condensed and rarefied media, 18: 16688
energy losses in solids, 18: 16544
energy losses of, method of calculating, 18: 16951(R) (TID-20311)
equilibrium properties of, with repulsive radial interaction, 18: 16809
interactions in emulsions at heights of 306 to 339 km, 18: 16732(T) (FTD-TT-64-90(p.163-76))
interactions in plasma, test particle kinetic theory of, 18: 17164
interactions of, cross sections for coulomb, 18: 16711
motion in adiabatically varying electromagnetic fields, 18: 17125
motion in axisymmetric magnetic barrier, nonadiabatic, 18: 17169
motion in circular accelerators, 18: 16612
motion in magnetic dipole field, 18: 16554(T) (FTD-TT-64-90(p.128-62))
motion in stationary heterogeneous magnetic field, invariants of, 18: 16553(T) (FTD-TT-64-90(p.80-109))
motion in stratified media, electromagnetic waves from, 18: 17190
slowing down in Maxwellian plasma, 18: 17211
CHEMICAL PROPHYLAXIS
book: *Anti-Radiation Properties of Gallates*, 18: 15904
radiosensitivity effects of natural substances in, 18: 15897
radiosensitivity effects of adenine in radiotherapy, 18: 15902
CHEMICAL RADIATION DETECTORS
design of dosimeter using polymerizable monomer liquid, 18: 16368(P)
performance of ceric sulfate, effects of copper sulfate on, 18: 16318
response of implanted silver metaphosphate glass to low-dose gamma radiation, 18: 15811(R) (LAMS-3034(p.133-40))
CHERENKOV DETECTORS
design for electron and gamma energy measurements, 18: 16330
CHERENKOV RADIATION
emission by charged particles moving in stratified media, 18: 17190
emission from moving mechanical impulse in perfect elastic conductor in isotropic magnetic field, 18: 16765

emission from moving mechanical impulse in perfect elastic conductor in anisotropic magnetic field, 18: 16766
production by mechanical impulse in liquids and solids, 18: 16767
production by mechanical impulse in liquids and solids, 18: 16768
CHICKENS
barium-133 and calcium-45 uptake by embryonic bones of, 18: 15803
irradiation of tumor cell transplants in embryos of, effects on cell virus-producing capacity, x, 18: 15838
CHIMERAS
erythropoiesis in mouse, 18: 15743(R) (LAMS-3034(p.279-85))
CHLORIDES
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
CHLORINE
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
nuclear quadrupole resonance in paradichlorobenzene, relaxation time for, 18: 16041
CHLORINE IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
CHLORINE ISOTOPES Cl-35
energy levels, 18: 16945 (NP-13601)
nuclear magnetic resonance spectra in silver chloride, gradient-elastic tensor from quadrupole broadening in, 18: 16562
CHLORINE ISOTOPES Cl-38
preparation and properties of, for use as neutron sources, 18: 16379
CHLOROFORM
analytical use for spectrometric determination of beryllium, 18: 15967
effects of deuterated and nondeuterated, on cyclohexane radiolysis, 18: 16082
CHLOROPHYLLS
deuterium-hydrogen exchange between solvents and, location of, 18: 16042(T)
CHOLESTEROL
metabolism of, production of fever-producing metabolites by, 18: 15755
CHROMATOGRAPHIC SEPARATIONS
of nucleic acids, evaluation of resins for, 18: 15780(R) (LAMS-3034 (p.350-72))
CHROMATOGRAPHY
development of recycle method for gas, for separation of isotopic molecules, 18: 16400 (TID-7689(p.89-93))
of nucleic acids, automated, 18: 15954(R) (LAMS-3034(p.313-18))
radio-, design of scanning unit and spreader for thin layer, 18: 16138
use of copolymerized cellulose in reversed-phase, 18: 16145
CHROMIUM
alloying effects on grain size of uranium, 18: 16509
content in red giant stars, theory for, 18: 16634
determination in chromium oxide-silver oxide, intensity ratio technique for x-ray spectrometric, 18: 15972
determination in petroleum and its products, activation, 18: 15968
determination of, design of atomic absorption spectrophotometer for, 18: 16281
diffusion in chromium–iron alloys, tracer studies of, 18: 16474 (NP-13738)
diffusion in vanadium, tracer studies of, 18: 16474 (NP-13738)
diffusion of iron in, tracer studies of, 18: 16474 (NP-13738)
fabrication by swaging and rolling, 18: 16423(R) (GEMP-197)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron reactions (n,γ) with, dose distributions from, 18: 16962
oxidation resistance of, effects of hafnium, thorium, and yttrium on, 18: 16423(R) (GEMP-197)
reduction of pentaamine-cobalt(III) complexes by, kinetics of, 18: 16018
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
CHROMIUM ALLOYS
Al–Cr, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Al–Cr–Re, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Fe, diffusion of chromium and iron in, tracer studies of, 18: 16474 (NP-13738)
Cr–Fe, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Fe–Ni, thermal neutron magnetic scattering at high temperatures, 18: 16506
Cr–Mo, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Re, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Ta, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–W, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
CHROMIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
CHROMIUM ISOTOPES Cr-50
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17092
proton reactions (p,t) with, T = T_z + 2 states from, 18: 16923 (ANL-6848(p.125-9))
CHROMIUM ISOTOPES Cr-51
energy levels of, properties of, 18: 17092
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
CHROMIUM ISOTOPES Cr-52
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17092
deuteron reactions (d,p) with, distorted-wave analysis of, 18: 16913 (ANL-6848(p.63-9))
proton inelastic scattering by, excited states from, 18: 17071
CHROMIUM ISOTOPES Cr-53
deuteron elastic scattering by, optical model analysis of, 18: 16913 (ANL-6848(p.63-9))
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17092
energy levels of, properties of, 18: 17092
CHROMIUM ISOTOPES Cr-54
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17092
energy levels of, properties of, 18: 17092
CHROMIUM ISOTOPES Cr-55
energy levels of, properties of, 18: 17092
CHROMIUM OXIDES
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
Cr_2O_3–Ag_2O, intensity ratio technique for x-ray spectrometric analysis for chromium and silver in, 18: 15972
CHROMIUM STEEL
corrosion by carbon dioxide at 450 to 825°C, 18: 16444
CHROMOSOMES
genetic analysis of, in monkey blood cells, 18: 15738(R) (LAMS-3034 (p.227-34))
morphology of, in mouse bone marrow, effects of ancestral irradiation on, 18: 15812(R) (LAMS-3034(p.303-6))
number of, in bone marrow from normal and leukemic mice, 18: 15744(R) (LAMS-3034(p.307-11))
radiation effects on human leukocyte, x, 18: 15840
radioinduced aberrations in mouse, x, 18: 15893
CHROMYL CHLORIDES
oxidation of deuterated and nondeuterated toluene mixture, deuterium isotope effects in, 18: 16072
CIRCUITS
development for particle detectors, 18: 16310(T) (SC-T-64-46)
CIVIL ENGINEERING
use of nuclear explosives to construct a sea-level transisthmian canal, 18: 16161 (SC-4929(RR))
CIVILIAN DEFENSE
Canadian programs for, 18: 16246
organization and training of physicians for, 18: 16245
water supply production from wastes in shelters, evaluation of processes

for, 18: 16228 (NP-13740)
CLAYS
ion exchange study of minerals in, 18: 16200
separation of radium and uranium by leaching using aqueous solutions of calcium chloride or sodium carbonate, 18: 16133
CLOUD CHAMBERS
design of 1-msec delay triggered, proposed, 18: 16295 (BNL-7534 (p.318-23))
design of 150-liter, for cosmic mesons (μ), 18: 16334
ion drift in, 18: 16335
particle tracks in, coordinate corrections for, 18: 16335
recovery time reduction in, 18: 16333
use for detecting sub-nuclear particles in the ZGS, 18: 16326
COAL
radiation effects on properties and reactions of anthracite, gamma, 18: 16523 (BM-RI-6391)
radium-226 content in Australian, 18: 16211
COAXIAL CABLES
radiation effects on conductance and replacement currents in, reactor, 18: 16522 (AD-429954)
COBALT
alpha reactions (α,n) at 42 Mev, angular distributions of neutrons from, 18: 16951(R) (TID-20311)
content in red giant stars, theory for, 18: 16634
determination in petroleum and its products, activation, 18: 15968
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
magnetic structure of hexagonal, 18: 16894(R) (MIT-3031-1)
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
COBALT COMPLEXES
with ethylenediamine dibromo- and dichloro-nitrates, effects of gamma pre-irradiation on recoil phenomena in neutron irradiated, 18: 16113
COBALT(III) COMPLEXES
pentaamine, reduction of, 18: 16018
COBALT(III) FLUORIDES
production by reaction of cobalt oxide and fluorine, 18: 17374(T) (UCRL-Trans-1043(L))
COBALT ISOTOPES Co-55
energy levels, 18: 16917 (ANL-6848(p.98-103))
COBALT ISOTOPES Co-59
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
alpha scattering at 28.5 Mev, nuclear states from, 18: 17046
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
neutron reactions with, resonances in, 18: 17035
neutron reactions (n,α) at 14 Mev, 18: 17057
proton inelastic scattering by, excited states from, 18: 17071
proton reactions (p,α), fluctuations in cross sections of, 18: 17078
COBALT ISOTOPES Co-60
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
separation from fission products by amalgam exchange, radiochemical, 18: 16148
use for abrasion control in machines, 18: 16394
COBALT OXIDES
melting temperature, evaluation for space technology, 18: 16521
reactions with fluorine for production of trifluoride, 18: 17374(T) (UCRL-Trans-1043(L))
COINCIDENCE CIRCUITS
design of anti-, for bi-directional decade counter, 18: 16313
COINCIDENCE COUNTERS
design, 18: 16304 (NP-13693)
COLORIMETRY
radiation dosimetry methods, 18: 16260
COMMUNICATION SYSTEMS
development for operation during polar cap blackouts, 18: 16841
effects of solar disturbances on, conference on, 18: 16822
plasma effects on overall transfer function of, 18: 17144
COMPRESSION
effects on annealing of radiation damage in lead nitrate crystals, 18: 16103
COMPTON EFFECT
detection and measurement of double, review, 18: 16771
on plasma stability, 18: 17203
COMPUTER PROGRAMS
developments at Lawrence Radiation Laboratory, 18: 16552(R) (UCRL-11132)
FICS, for few-group constants in KARE diffusion theory system, 18: 16893 (KAPL-M-6119)
for calculating intensities in vibrational structure of electron transitions, 18: 16651 (UCRL-10925)
for energy loss calculations for charged particles on IBM 709, 18: 16951(R) (TID-20311)
for reactor calculations, summary of, 18: 17279 (KAPL-M-JDJ-1)
FORTRAN II for IBM 704/7090, for analysis of sedimentation data of DNA, 18: 15778(R) (LAMS-3034(p.319-25))
FORTRAN, for biological tracer studies for IBM 7090, 18: 15737(R) (LAMS-3034(p.168-79))
INTERSET, for fissile cylinder interaction calculations, 18: 16737 (HW-80213)
SOPHIST-5, for calculating energy transfer matrices for anisotropic neutron elastic scattering, 18: 16897 (UCRL-7624)
STATOR, for statistical calculation of thermal-hydraulic correction factors in ORGEL core, 18: 17296 (EURAEC-910)
TURBO*, for two-dimensional reactor depletion calculations, 18: 17280 (WCAP-6059)
COMPUTERS
design and performance for automatic reactor calculations, 18: 17250 (PAN-O-117)
flying-spot film digitizer design for, 18: 16414 (UCRL-7619)
operation and programming, 18: 16552(R) (UCRL-11132)
performance of IBM 1620, in multidimensional analyzer, 18: 16321
research program on, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
use in analysis of data from biological tracer studies, 18: 15737(R) (LAMS-3034(p.168-79))
CONCRETES
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
CONFERENCES
Calorimetry, All-Union Conference on, Leningrad, June 17 to 22, 1963, 18: 17369(T) (ANL-Trans-4)
CERN Synchrotron and Synchrocyclotron, Vol. I, Herceg-Novi, May 18-31, 1964, 18: 16606 (CERN-64-13(Vol.I))
CERN Synchrotron and Synchrocyclotron, Vol. II, Herceg-Novi, May 18-31, 1964, 18: 16607 (CERN-64-13(Vol.II))
CERN Synchrotron and Synchrocyclotron, Vol. III, Herceg-Novi, May 18-31, 1964, 18: 16608 (CERN-64-13(Vol.III))
Crystallography and Crystal Perfection, Madras, Jan. 14–18, 1963, 18: 16433
Effects of Disturbances of Solar Origin on Communications, Naples, May 1961, 18: 16822
Immonopathology, Third International Symposium on, Scripps Clinic and Research Foundation, La Jolla, California, January 1963, 18: 15754
Ionization Phenomena in Gases, VI International Conference on, Paris, July 8-13, 1963, Vol. I, 18: 16689
Ionosphere, International, London, England, July, 1962, 18: 16847
Nuclear Physics, Orsay, France, May 1963, 18: 16561
Nuclear Spectroscopy with Direct Reactions, Chicago, March 1964, 18: 16905 (ANL-6848)
Personnel Dosimetry Techniques for External Radiation, Madrid, 1963, 18: 16253
Plasma Phenomena and Measurement, IEEE-PTGNS Tenth Anniversary Meeting, San Diego, Oct. 29 to Nov. 1, 1963, 18: 17126
Quantum Theory and Theory of Elementary Particles, Uzhgorod State Univ., Oct 2–6, 1958, 18: 16795
Radioisotope Conference, Second Annual Oak Ridge, ORINS and ORNL, April 19 to 22, 1964, 18: 16378 (TID-7689)
Radioisotope Conference, Research Applications to Physical Science and Engineering, Oak Ridge, April 1 to 3, 1963, 18: 16382 (TID-7688)

Retention and Migration of Radioactive Ions in Soils, Saclay, Oct. 16–18, 1962, 18: 17336
Storage Rings, Accelerators and Experimentation at Super-High Energies, Brookhaven National Lab., June 10 to July 19, 1963, 18: 16583 (BNL-7534)
Synthesis and Structure of Macromolecules, Cold Spring Harbor, N. Y., 1963, 18: 15805
CONTAMINATION
human internal, maximum permissible dose for, 18: 15910
of atmosphere with beryllium, sampling methods for measuring, 18: 16236
radioactive environmental, effects on rat weight, 18: 15760
COPPER
alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
argon ion large-angle scattering, 18: 16667
determination in copper oxide-iron oxide powders, intensity ratio technique for x-ray spectrometric, 18: 15972
determination in petroleum and its products, activation, 18: 15968
determination of, design of atomic absorption spectrophotometer for, 18: 16281
electron spin-orbit coupling constants for 4d and 4f shell, 18: 16664
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
heat capacities at low temperatures, measurement of, 18: 16886
proton reactions at 100 to 500 kev, production of L-shell x rays by, 18: 16663
radiation effects on stress-strain curves of single crystals of, neutron, 18: 16530(T) (AEC-tr-6373)
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (AI-Trans-38)
relaxation phenomena in wires of cold-worked, effects of interstitial atoms on, 18: 16484(T) (AI-Trans-34)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
sputtering by noble gas ions, focusing model for, 18: 16672
sputtering by noble gas ions at 20 kev, temperature dependence of, 18: 16673
superconductivity of lead filaments in matrix of, 18: 16878(R) (SSD-TDR-63-98)
COPPER IONS
effects on radioinduced oxidation of ferrous sulfate in sulfuric acid, 18: 16095
COPPER ISOTOPES Cu-59
energy levels, 18: 16917 (ANL-6848(p.98-103))
COPPER ISOTOPES Cu-63
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
neutron reactions (n,α) at 14 Mev, 18: 17057
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
COPPER ISOTOPES Cu-65
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
gamma spectra of, low-energy, 18: 16980
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
COPPER ISOTOPES Cu-66
magnetic moment and spin of, measurement of, 18: 17068
COPPER OXIDES
CuO–Fe_2O_3, intensity ratio technique for x-ray spectrometric analysis for copper and iron in, 18: 15972
COPPER SULFATES
effects on radiolysis of ceric sulfate solutions, 18: 16318
CORROSION
book: *Corrosion of Metals and Alloys*, 18: 16446
in water-cooled reactors, problems of, 18: 16445
CORROSION INHIBITORS
properties of potassium pertechnetate as, 18: 16443(T) (ORNL-tr-32)
CORROSION LOOPS
design of high temperature supercritical water, 18: 16441 (WCAP-2056 (Pt.I))
development for testing steels in steam and water, 18: 16442(T,R) (EURAEC-960)
operational experience of high-temperature supercritical pressure water, 18: 16179 (WCAP-2056(Pt.II))
COSMIC MESONS (μ)
detection of, Wilson chamber for, 18: 16334
polarization, 18: 16762 (NP-13694)
COSMIC PARTICLES
atmospheric absorption of charged, during geomagnetic activity, 18: 16734
effects on polar geomagnetic activity, 18: 16871
flux of, at 306 to 339 km, 18: 16732(T) (FTD-TT-64-90(p.163-76))
fragmentation of heavy, at 1 to 15 Tev, 18: 16728 (BNL-7534(p.2-28))
interactions with emulsions, secondary jets at greater than 1 Tev from, 18: 16728 (BNL-7534(p.2-28))
ionospheric effects of, 18: 16733
COSMIC PHOTONS
absorption of r-f, by ionosphere during geomagnetic activity, 18: 16734
detection and measurement of solar, below 20 Å, 18: 16640
emission of solar x, during flare and quiet periods, 18: 16645
emission of solar, measurement and theory, 18: 16641
ionizing effects of solar, in ionosphere, 18: 16848
COSMIC PROTONS
effects of solar, on D layer of ionosphere, 18: 16642
interactions with protons in liquid hydrogen at 300 Bev, diffraction peak width parameter for elastic, 18: 16729 (BNL-7534(p.29-38))
spectra in South Atlantic anomaly, 18: 16552(R) (UCRL-11132)
COSMIC RADIATION
effects on immunizing property of tubercle bacilli, 18: 15883
effects on tubercle bacilli virulence, 18: 15884
effects on tuberculosis, altitude dependence of, 18: 15882
hazards in solar system, 18: 16735
research on, 18: 16730(T) (FTD-TT-64-90)
use in high-energy experiments, 18: 16729 (BNL-7534(p.29-38))
COSMOLOGY
energy partition in, 18: 16815
COUNTING DEVICES
design of bi-directional decade counter with anti-coincidence network and digital display, 18: 16313
CRATERS
engineering properties of nuclear, 18: 16162 (UCRL-7657)
CREATININE
radiation effects on excretion of, by thyroparathyroidectomized rat, x, 18: 15876
CRITICAL ASSEMBLIES
critical experiments on slightly enriched uranium metal fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
criticality studies of German zero reactor, theoretical, 18: 17281 (ZFK-TPH-5)
criticality studies on ZR-I (Hungary), determination of β^{***}/l, 18: 17284
description of KRITO, for studies of NERO core parameters, 18: 17276 (EUR-498.e)
description of PUK, for studies of NERO light water-moderated core with low-enrichment fuel, 18: 17277 (EUR-499.e)
nuclear excursions of, monitoring of, 18: 16242
reactivity of PMA, effects of aluminum on, 18: 16738 (KAPL-M-6121)
CRITICALITY STUDIES
core models for, review of, 18: 17279 (KAPL-M-JDJ-1)
experiments on light water-moderated lattices using low-enrichment fuels in KRITO facility, 18: 17276 (EUR-498.e)
interactions of cylinder, eigenvalue matrix treatment of, 18: 16737 (HW-80213)
CROSS SECTIONS
flucutations in integrated, analysis of, 18: 17072
CRYSTALLOGRAPHY
conference, 18: 16433
CRYSTALS
analysis of hydrogen-bonded, neutron-diffraction, 18: 16055
neutron diffraction by ideal, 18: 16510
CUPFERRON COMPLEXES
with iron, isotopic exchange of iron with iron chloride and, 18: 16402
CURITES

synthesis, 18: 16009
CURIUM
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
CURIUM COMPOUNDS
properties of, review of, 18: 16051
CURIUM ISOTOPES Cm-244
recoil thrust on flat-plate alpha sources of, 18: 17324
CYCLOHEXANE
cyclohexane-iodide, free radical yields in Szilard-Chalmers reactions in, 18: 16112
radiolysis of, effects of carbon tetrachloride and deuterated and nondeuterated chloroform on, 18: 16082
radiolysis of, linear electron transfer effect in, 18: 16102
Szilard-Chalmers reactions in, free radical yields in, 18: 16112
cyclohexane–methanol-*d*, vapor pressure, 18: 16066 (NP-13736)
CYCLOHEXANE, DECAFLUOROBIS(TRIFLUOROMETHYL)-
decafluorobis(trifluoromethyl)cyclohexane–UF_6, vapor-liquid equilibria, 18: 15995 (K-271)
CYCLOTRONS
beam adjustment in, arrangement of measuring probes for, 18: 16618
beam defining slit system design modifications for University of Washington, 18: 16951(R) (TID-20311)
beam energies of, system for measuring, 18: 16611 (ZFK-PHA-5)
deuteron sources for, development of polarized, 18: 16617
development and operation, 18: 16552(R) (UCRL-11132)
radioisotope production in ORNL 86-inch proton, 18: 16399 (TID-7688 (p.5-7))
CYLINDERS
alpha particle detection, dosimetry, and spectrometry in systems of, 18: 16316
alpha particle distribution in, differential and integral, 18: 16316
interactions between fissile, matrix theory for, 18: 16737 (HW-80213)
CYTOLOGY
electronic measurement of cell volumes in, 18: 15739(R) (LAMS-3034 (p.235-52))
of deuteron effects on sarcoma cells in tissue culture, 18: 15829
radiation effects on rat spleen cells, 18: 15863
radiation effects on subcellular responses in liver cells tissue culture, 18: 15864
sample preparation of monkey blood, 18: 15738(R) (LAMS-3034(p.227-34))
CYTOPLASM
radiation effects on relation to nuclei, review, 18: 15867

D

DATA RECORDING SYSTEMS
design for Harwell solid-state scalers, 18: 16275 (AERE-M-1332)
design of, with photograph scanner, 18: 16414 (UCRL-7619)
development and operation, 18: 16552(R) (UCRL-11132)
efficiency of analog and digital, for radioisotope concentrations measured during scanning of internal organs, 18: 15917 (TID-7689 (p.25-8))
DATA TABULATIONS
book: *Constants in Nuclear Physics*, 18: 17255
book: *Decay Scheme of Radioactive Nuclei A ≥ 100*, 18: 17099
group constants for fast and intermediate neutrons, 18: 17287 (NP-13666)
melting points of 70 metal oxides, 18: 15996 (NBS-MON-68)
nebular recombination spectra, 18: 16631
neutron activation characteristics of elements, thermal, 18: 15956 (NP-13762)
neutron cross sections of plutonium-241, Doppler-broadened, 18: 16942 (IDO-16954)
stellar spectra, 18: 16630
DECAY SCHEMES
book: *Decay Scheme of Radioactive Nuclei A ≥ 100*, 18: 17099
DECONTAMINATION
device for water, 18: 16249
use of ultrasonic, for glass, metals, plastics, and textiles, 18: 16250
DEHYDROGENASES
radiosensitivity in sporulating *B. subtilis*, x, 18: 15845
DENSITOMETERS
design of alpha-particle, 18: 16383 (TID-7688(p.7-13))
DETONATION WAVES
electron density and continuum radiation behind, 18: 16648 (NP-13739)
DEUTERIUM
abstraction by methyl radicals, isotope effects in, 18: 16071
argon rearrangement collisions at high energies, 18: 16676
deuteron reactions (d,n) with, neutron polarization from, 18: 16992
effects on methyl radical abstraction reactions, 18: 16071
effects on methyl radical formation in irradiated methyltrideuteriomethylphenylcarbinyl hypochlorite, 18: 16086
effects on oxidation of deuterated and undeuterated toluene mixture by chromyl chloride, 18: 16072
electron temperature in plasma of, spectroscopic determination of, 18: 17185
electron-diffraction patterns of solid, 18: 16576
exchange between ammonia and hydrogen, 18: 16126(P)
exchange between chlorophyll and solvents, location of, 18: 16042(T)
exchange between liquid ammonia and gaseous hydrogen, process and apparatus for, 18: 16406(P)
exchange reactions with methane on platinum, ruthenium, and their alloys, catalytic, 18: 16034
incorporation in alkyl benzenes, mechanisms of σ-complexes in catalytic, 18: 16040
isotopic effects on hydrogen bonds, 18: 16066 (NP-13736)
neutron elastic scattering by, at 14.1 Mev, 18: 16964
plasma impurity radiation losses from theta pinch, 18: 17167
plasma of, impurity effects of carbon on high-density, 18: 17179
production of plasma of, device for, 18: 17242(P)
separation by nitric acid–water countercurrent distillation, 18: 16405(P)
separation from hydrogen by liquefaction and fractionation, 18: 16407(P)
DEUTERIUM IONS
reactions with argon at high energies, rearrangement, 18: 16676
DEUTERON BEAMS
generation of polarized, development of source for, 18: 16617
modulation of 150-kev, with 5 Mc/sec repetition rate, 18: 16614
DEUTERONS
biological effects in mammals, 18: 15826
biological effects on sarcoma cells in tissue culture, 18: 15829
detection and discrimination using organic phosphors, 18: 16324
effects on lithium fluoride crystals, spectra of coloration induced by, 18: 16108
effects on mouse skin, 18: 15827
interactions of, neutron spectra from, 18: 16323
interactions with deuterons, 18: 16552(R) (UCRL-11132)
interactions with mesons (K^-) at 765 Mev/c, mesons (η) production in, 18: 16783
photodisintegration of, research progress on, 18: 16953(R) (TID-20352)
properties of, book on, 18: 17097
reactions (d,α) with magnesium-24, energy levels from, 18: 17055
reactions (d,α) with aluminum-27, cross section fluctuations in, 18: 17072
reactions ($d,d'\gamma$) with magnesium-24, deuteron-gamma correlation in, 18: 16922 (ANL-6848(p.123-4))
reactions (d,He^3) with nuclei near A = 40, 18: 16931 (ANL-6848(p.177))
reactions (d,n) and (d,p), model for, 18: 17053
reactions (d,n) with deuterium, neutron polarization from, 18: 16992
reactions (d,n) with iron-54 and nickel-58, 18: 16917 (ANL-6848 (p.98-103))
reactions (d,n) with tritium at 21 Mev, 18: 16951(R) (TID-20311)
reactions (d,n) with carbon-12, cross sections and neutron polarization for, 18: 16908 (ANL-6848(p.16-23))
reactions (d,pγ) with nuclei, angular correlations from, 18: 16993
reactions (d,p) and (d,t) with carbon isotopes, 18: 16914 (ANL-6848(p.70-8))
reactions (d,p) with silicon-29, proton polarization from, 18: 16994
reactions (d,p) with aluminum-27 at 6.6 Mev, differential cross sections for, 18: 17091
reactions (d,p) with chromium isotopes at 6.6 Mev, angular distributions for, 18: 17092
reactions (d,p) with iron isotopes at 6.6 Mev, angular distributions for, 18: 17093

reactions (d,p) with chromium-52, distorted-wave analysis of, 18: 16913 (ANL-6848(p.63-9))
reactions (d,p) with titanium-47 at 6 Mev, 18: 16915 (ANL-6848 (p.79-85))
reactions (d,p) with tungsten isotopes at 12 Mev, 18: 16916 (ANL-6848(p.86-97))
reactions (d,p) with magnesium-26, 18: 16918 (ANL-6848(p.104-5))
reactions (d,p) with zirconium-90, distorted-wave analysis of, 18: 16909 (ANL-6848(p.30-7))
reactions (d,p) with bismuth-209, potential range and polarization effects in, 18: 16911 (ANL-6848(p.43-50))
reactions (d,p) with uranium-238 at 12 Mev, 18: 16912 (ANL-6848 (p.52-62))
reactions with carbon-12, excitation functions for, 18: 16991
reactions with nuclei, distributions from polarized, 18: 16617
scattering by chromium isotopes at 6.6 Mev, angular distributions for elastic, 18: 17092
scattering by iron isotopes at 6.6 Mev, angular distributions of elastic, 18: 17093
scattering by nuclei, nuclear tensor potentials from elastic, 18: 17041
scattering by silicon-28, angular distributions from, 18: 17021

DIABETES
radiotherapy for, alpha and proton, 18: 15927

DIAMONDS
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
synthesis with radioactive surface coating for preventing static electricity charges, 18: 16436(P)

DICARBOXYLIC ACIDS
radiolysis of, electron spin resonance spectra of free radicals in, 18: 16091

DIDO REACTORS
iodine removal from, 18: 16033

DIELECTRIC CONSTANTS
calculation for fully ionized plasma, 18: 17202
of argon afterglow plasma, 18: 17234

DIET
analysis of, for radioactivity in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
strontium-90 content in United Kingdom, uptake by infants' bones, 18: 15796
strontium-90 levels in brown trout, 18: 16243

DIFFUSION
radiation effects on solid-state, 18: 16543

DIODES
electric power production by thermionic, using fission product ionization, 18: 16740(R) (AD-425231)
radiation damage in uniform silicon avalanche, 18: 16528 (SC-DC-64-346)
use of tunnel, in particle detection circuitry, 18: 16310(T) (SC-T-64-46)

DISASTERS
personnel for radiological, psychological considerations in selection and training of, 18: 16270

DISEASES
of parathyroid glands, effects of carcinomas on, 18: 15750
radiation effects on dog immunity to anthrax, x, 18: 15858

DISSOLVERS
corrosion of construction materials for, by acids, 18: 16152

DISTILLATION
vacuum, tracer study of, 18: 16386 (TID-7688(p.40-3))

DISULFIDES
preparation for use as anti-radiation drugs, 18: 15895(R) (NP-13730)

DOGS
calcium-47 distribution and kinetics in, effects of adrenal steroids on, 18: 15795
cesium-137 content of beagle hounds, 18: 15771(R) (LAMS-3034(p.73-5))
cesium-137 distribution in tissues of, after chronic exposure, 18: 15766(R) (LAMS-3034(p.41-8))
cesium-137 excretion and muscle cell retention, comparison with potassium, 18: 15783 (TID-7689(p.55-8))
pathological effects of injected plutonium-239 in, 18: 15817(T) (FTD-TT-63-559(p.150-72))
potassium-40 content of beagle hounds, 18: 15771(R) (LAMS-3034(p.73-5))
radiation dose distribution in, phantom measurement accuracy for, 18: 15753
radiation effects on glycogen content of eye in, x, 18: 15837(T)
radiation effects on immunity of, to anthrax, 18: 15858
radiation effects on kidneys in, under high oxygen tension, x, 18: 15880
radiation effects on response to hemorrhagic stress of, 18: 15886
radiation effects on sperm production in, x, 18: 15892
radioinduced mitotic delay in erythroblasts of, x, 18: 15874
selenium-75 transfer across pericardium in, 18: 15804

DOUNREAY FAST REACTOR
operation of, chemical problems in, 18: 17310

DRUGS
effects of chlordiazepoxide on iodine metabolism in rat thyroid, 18: 15787
effects of chlordiazepoxide on thyroid secretory activity in rats and mice, 18: 15788
uses of labeled, in studies of biological processes, 18: 15784 (TID-7689(p.58-62))
uses of sulfur-35-labeled, for studies of blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))

DUCTILITY
of thick steels, measurement by Robertson bend tests, 18: 16458(T,R) (EURAEC-811)

DUSTS
pulmonary deposition and retention of inhaled, 18: 15806

DYES
fluorescent, use to demonstrate lipids in tissues for microscopic examination, 18: 17373(T) (UCRL-Trans-1033)
separation by reversed-phase chromatography using polymerized cellulose, 18: 16145

DYSPROSIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131

DYSPROSIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505

DYSPROSIUM FLUORIDES
$NH_4F–DyF_3$, chemical properties and crystal structure, 18: 16013

DYSPROSIUM ISOTOPES Dy-150
production by proton reactions on terbium-159, 18: 16975

DYSPROSIUM ISOTOPES Dy-151
production by proton reactions on terbium-159, 18: 16975

DYSPROSIUM ISOTOPES Dy-160
energy level at 87 kev, lifetime of, 18: 17085

E

EARTH
electric currents in, during geomagnetic agitation, 18: 16860
geomagnetic symmetries of electric currents in, at high latitudes, 18: 16869
radioisotope migration and retention in lithosphere at NRTS, Idaho, 18: 17349

EARTHQUAKES
seismic wave detection on ocean bottom, 18: 16198

ECOLOGY
of a mesic forest ecosystem, tracer study, 18: 15762
of forest, effects of Malathion aerial spray on, 18: 17362(R) (TID-20355)
of North Sea Area, 18: 17334 (NP-13756(Vol.I))
of radiation, survey, 18: 16212

ELECTRIC ARCS
characteristics of high-voltage vortex-stabilized arc heaters, 18: 16283
constriction static pressure distribution and voltage gradient in, 18: 17134
energy transport and flow processes in arc gas heater tube, 18: 17132
ion motion in cathode sheath of, 18: 17239
plasma generation by wall-constricted d-c, 18: 17133
stability of high-density nanosecond, 18: 17235

ELECTRIC CONDUCTIVITY
calculation of, for given densities, 18: 16513
effects of magnetic field and temperature on, 18: 16660
mechanisms of, between electrodes in argon plasma, 18: 17222

ELECTRIC CURRENTS

distributions of earth-dynamo, in ionosphere, 18: 16866
effects on purification of lead–tin alloys by solidification, 18: 16428(T) (AEC-tr-6366)
geomagnetic symmetries of telluric, at high latitudes, 18: 16869
ELECTRIC DISCHARGE
afterglow of, electron density and collision frequency in nitrogen, 18: 17141
afterglow studies of transient, 18: 17231
afterglow tails from, in air, 18: 17235
charged particle density in, determination of, 18: 16659(T)
double sheath at constrictions in column for, Langmuir probe studies of, 18: 17237
electron distribution function relaxation rate in afterglows from, 18: 17233
electron energy decay in afterglow from, in helium, 18: 17232
measurements in a mil-type plasma gun, 18: 17131
positive column characteristics of mercury arc, effects of axial magnetic field on, 18: 17142
properties of luminescent, coefficient of recombination for, 18: 17236
striation motion in high-current d-c, 18: 17124
thermal equilibrium in, criteria for, 18: 17216
ELECTRIC FIELDS
effects on NMR in gases and liquids, 18: 17065(T)
measurement in plasma, Stark effect for, 18: 17188
positive ion movement through inhomogeneous, 18: 17221
production by charged particles in plasma, 18: 17205
theory of atomic, eigenfunctions for, 18: 16658
use in ionization of excited hydrogen atoms, 18: 16709
ELECTRIC POWER
developments in thermionic conversion, review on, 18: 17254
production of, MHD systems for pulsed, 18: 16743 (MHD-646)
ELECTRIC PROBES
cation collection in plasma, 18: 17186
properties of Langmuir, dynamic, 18: 17182
properties of Langmuir, dynamic, 18: 17183
ELECTROCHEMISTRY
oxidation of ferrocyanide by rotating disk electrode, effects of rotation and polarization rates on, 18: 16004 (TID-20339)
ELECTRODES
development of collector, for nuclear-thermionic cells, 18: 16742(R) (GA-4804)
effects of segmented, on magnetohydrodynamic cell performance, 18: 16741 (BSD-TDR-63-248)
electric conductivity between, in argon plasma, 18: 17222
ELECTRODYNAMICS
book: *Fundamentals of Cosmic Electrodynamics*, 18: 17122(T) (NASA-TT-F-175)
electromagnetic field equations for moving electron, 18: 16797
ELECTROLYTES
morphology of interface between liquid and solid, 18: 16005(R) (TID-20354)
ELECTROMAGNETIC FIELDS
guiding centers for adiabatically varying, 18: 17125
production by constant velocity electrons, equations for, 18: 16797
ELECTROMAGNETIC SEPARATION
use in nuclear reaction studies in continential Europe, 18: 16950 (SGAE-PH-2/1964)
ELECTROMAGNETIC WAVES
Cherenkov absorption of "whistles" by plasma, 18: 17153
emission by charged particles moving in stratified media, 18: 17190
propagation in argon afterglow plasma at 9280 Mc in magnetic field, whistler-mode, 18: 17187
propagation in circular plasma column, dispersion equation with impedance boundary conditions for, 18: 17130
propagation of symmetric, in plasma, 18: 17189
propagation through a diffusion plasma in slab geometry, 18: 17129
ELECTROMAGNETISM
book: *Theoretical Electromagnetism*, 18: 16578
ELECTRON BEAMS
effects on alanine and glycine, design of air spark light source for spectra of, 18: 16101
effects on cation exchange materials, 18: 16117
excitation of plasma oscillations, 18: 17112 (NP-13697)
reactions with molecules, spectroscopic studies of inelastic, 18: 16700
ELECTRON TUBES
design for measuring magnetic field in a-c accelerator, 18: 16626
development of deuterium-filled, for high-power switching, 18: 16167
ELECTRONIC EQUIPMENT
description of multidimensional analyzer for nuclear-physics uses, 18: 16321
description of multidimensional analyzer for nuclear-physics uses, 18: 16322
design for automatic temperature control of gas-cooled reactors, 18: 17308
development for accelerator research, 18: 16951(R) (TID-20311)
development for particle detector circuitry, 18: 16310(T) (SC-T-64-46)
development of low-temperature, summary, 18: 16878(R) (SSD-TDR-63-98)
use for measurement of cellular volumes, 18: 15739(R) (LAMS-3034 (p.235-52))
ELECTRONS
attenuation by sapphire films, 18: 17244 (NASA-SP-3008)
capture by helium and hydrogen ions into excited state, 18: 16705
capture by protons from hydrogen atoms, cross sections for, 18: 16675
capture in betatrons without oscillations, mechanism of, 18: 16622
Cherenkov absorption of "whistles" by plasma, 18: 17153
collisions with hydrogen ions, electron detachment in, 18: 16683
collisions with solid targets at 0 to 50 kev, angular x-ray distributions from, 18: 16685
correlation functions for atoms with two-, exponential, 18: 16655
density above ionospheric F2 layer, 18: 16877
density behind blast wave in gas, 18: 16648 (NP-13739)
density matrix for, approximate method for calculating, 18: 16652(T) (UCRL-Trans-1026(L))
detection and measurement by luminescent dosimeters, 18: 16305 (NP-13748)
diamagnetic susceptibility of small systems of, 18: 16812
diffusion coefficient and drift speed in hydrogen and nitrogen, 18: 16724
distribution function relaxation rate in afterglows of electric discharges, 18: 17233
distributions in ionospheric F2 region, solar effects on, 18: 16643
distributions in ionosphere, 18: 16848
distributions in ionospheric F region, 18: 16849
distributions in ionosphere, use for ion-temperature measurement, 18: 16852
distributions in ionosphere, 18: 16866
distributions of ionospheric, about the magnetic equator, 18: 16853
distributions of ionospheric E layer, diurnal variations of, 18: 16864
dose distribution in grid therapy using, 18: 15943
drift velocities through hydrogen, method of measuring, 18: 16723
drift velocity in helium at 300°K and $10 \leq E/P \leq 300$ v/cm-torr, 18: 17220
effects on helium secondary ionization processes, 18: 16677
emission of thermo-, by potassium chloride crystals, 18: 16083
energy and movement exchange with ions in flowing plasma, 18: 17210
energy decay in afterglow of pulsed electric discharge in helium, 18: 17232
energy of, detector for measuring, 18: 16330
energy of, determination of self-, 18: 16808
energy spectrum in betatron radiation, 18: 16625
energy state density and localization in liquid model, 18: 16578
energy states in nebular hydrogen, 18: 16633
energy transfer with ions in two-temperature gas, 18: 16549 (ATN-64 (9232)-1)
energy transitions in nebular hydrogenic ions, 18: 16632
exchange in aqueous iron solutions, proton mobility and, 18: 16019
field equations for constant velocity, 18: 16797
heating in weakly ionized gas in crossed electric and magnetic fields, 18: 17214
injection in earth's geomagnetic field by delayed decay of fission products from high-altitude nuclear explosions, 18: 16213
injection into synchrotron, betatron-injection synchronization for, 18: 16624

interacting gas of, solutions of Fokker-Planck equations for, 18: 16818
interactions with electrons, Stanford storage ring development for, 18: 16587 (BNL-7534(p.209-27))
interactions with neutrinos and antineutrinos, cross sections for elastic, 18: 16760 (LAMS-3013)
interactions with gamma photons, double Compton effect in, 18: 16771
mobilities in weakly ionized plasma, 18: 17219
mobility in noble gases, 18: 16668
motion in uniform plasmas, analysis of, 18: 17146
oscillations in bounded nonuniform plasma in magnetic field, 18: 17180
paramagnetic resonance of, spectrometer for, 18: 16342
radiation dosimetry methods, 18: 16260
radiotherapy using, from linear accelerator, physical aspects of, 18: 15922
radiotherapy using 15-Mev, 18: 15923
reactions on beryllium-9, cross sections for fission, 18: 17024
reactions with atoms in helium discharge afterglow at 4.2°K, 18: 17193
reactions with helium and hydrogen, ionization in, 18: 16695
reactions with hydrogen, ionization of excited states in, 18: 16691
reactions with hydrogen, calculations of ionization curve for, 18: 16693
reactions with hydrogen ions in plasma, recombination, 18: 17184
reactions with nebular hydrogenic ions, spectra of recombination, 18: 16631
reactions with oxygen, ionization in, 18: 16694
reactions with polyatomic molecules, diabatic effect on ionization in, 18: 16692
reactions with rare gases, ionization cross sections for, 18: 16696
reactions with silver foils, transition radiation in, 18: 16649 (ORNL-3485)
recombination with ions for case of continuous distribution of atomic energy levels, 18: 16726
scattering by aluminum-27 at high energy, inelastic, 18: 16944 (LAL-1091)
scattering by carbon-12 at 200 Mev, spectra from inelastic, 18: 17028
scattering by helium ions at 44.2 to 217.6 ev, excitation cross sections for, 18: 16681
scattering by helium ions, cross sections for, 18: 16682
scattering by hydrogen atoms, cross sections for elastic, 18: 16690
scattering by lithium-6 and -7, form factors for inelastic, 18: 17026
scattering by neutral atoms of slightly ionized methane–oxygen mixture, cross sections for, 18: 16702
scattering by nitrogen molecules, vibrational excitation in, 18: 16699
scattering by oxygen-16, excited states from inelastic, 18: 17027
scattering by phosphorus-31, excited states from inelastic, 18: 17025
scattering by rare gases, structure beyond ionization limit in inelastic, 18: 16697
scattering factors for, analytical expressions for, 18: 16656
storage ring for 450-Mev, design of, 18: 16609 (LAL-1081)
temperature in semiconductors, effect of electric fields on, 18: 16882
temperature relaxation rates in strong magnetic field, 18: 17217
temperatures in plasma, spectroscopic determination of, 18: 17185
transfer of, NMR spectral effects of, 18: 16027
variations of ionospheric, during geomagnetic storms, 18: 16857
wave functions for atomic, perturbation calculations of, 18: 16800

ELECTROSTATIC ANALYZERS
design, 18: 17103 (ARL-64-6)

ELECTROSTATIC GENERATORS
ion sources for, design of lithium-isotope, 18: 16615

ELEMENTARY PARTICLES
biological effects in mammals, 18: 15826
conference, 18: 16795
decay of, analysis of neutral particle cascade, 18: 16761 (NIRL/R/56)
detection in ZGS, equipment for, 18: 16326
interactions of field theory for many-body, 18: 16814
interactions of, amplitudes on unphysical sheets and resonance poles in, 18: 16786
interactions of, graphical methods and Green's functions for, 18: 16763 (NP-13701)
interactions of, Lorentz transformations for two-body, 18: 16754 (CERN-64-13(Vol.I)(p.177-87))
interactions of, phase space representation of, 18: 16755 (CERN-64-13(Vol.II)(p.1-73))
interactions of, principle of equivalence for strong, 18: 16785
interactions of, theory for weak, 18: 16759 (CERN-64-13(Vol.III)(p.81-110))
interactions of, theory of, 18: 16552(R) (UCRL-11132)
properties of resonance, review, 18: 16770
research program on, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
scattering of relativistic, 18: 16769
scattering theory and symmetry classification for, 18: 16758 (CERN-64-13(Vol.III)(p.1-79))
spins of, methods for determining, 18: 16757 (CERN-64-13(Vol.II)(p.113-92))

ELEMENTS
analysis of light, design of vacuum grating spectrometer for electron probe micro-, 18: 15986
beta scattering by compiling data on excitation spectra from, 18: 16650 (TID-7689(p.80-1))
decay of heavy, estimation of galaxy chronology from, 18: 16639
determination in helium stars, 18: 16630
neutron activation characteristics, table of data on thermal, 18: 15956 (NP-13762)

EMBRYOLOGY
radiation effects on nuclei-cytoplasmic interrelation in animal, review, 18: 15867

EMBRYOS
effects of implants of liver from, on erythropoiesis in anemic mice, 18: 15743(R) (LAMS-3034(p.279-85))
irradiated tumor cell transplants in chick, detection method for virus-producing capacity of, 18: 15838
radiation effects on mouse, x, 18: 15891
radiation effects on rat, maternal role in, x, 18: 15894

ENZYMES
activity of spleen, effects of x radiation and nitrogen mustard on, in rats, 18: 15822
brain content in rats, behavior effects, 18: 17364 (UCRL-11179)
effects on nucleic acid synthesis in barley seed, 18: 17361(R) (TID-20353)
radiation effects on activity of, in extracts of tissue culture cells, 18: 15831
radiation effects on synthesis of, in Pseudomonas, x, 18: 15871
radiation effects on, in rabbits, 18: 15879
radiosensitivity in sporulating *B. subtilis* of transminase, x, 18: 15845
reaction mechanisms of, involved in protein synthesis, 18: 15805
ribonucleic acid polymerase inhibition by 6-azauridine triphosphate, 18: 15751

EPITHELIUM
radiation effects on alveolar, in man and rabbits, 18: 15889

EQUATION OF STATE
calculations of, for hydrogen, 18: 16056

EQUIPMENT AND PROCEDURES
design of radiometric, for abrasion control in machines, 18: 16394
design of, for thyroidal iodine-131 uptake studies, 18: 15919
for dose reduction to radium technicians, design of, 18: 15924

ERBIUM
photon scattering by, giant resonance effects on elastic, 18: 17040
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from neodymium by zone crystallization in nitrate medium and by precipitation using ammonium sulfate, 18: 16137

ERBIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505

ERBIUM FLUORIDES
$NH_4F–ErF_3$, chemical properties and crystal structure, 18: 16013

ERYTHROCYTES
cellular volumes of, electronic measurement of, 18: 15741(R) (LAMS-3034(p.261-9))
cellular volumes of, effects of age on, 18: 15742(R) (LAMS-3034(p.270-8))
radiation effects on sodium ion flux in human, x, 18: 15873
size of, in solution, effects of pH of saline solutions on, 18: 15740(R) (LAMS-3034(p.253-60))

ERYTHROPOIESIS
in mouse chimeras, 18: 15743(R) (LAMS-3034(p.279-85))

radiation effects on response of mice to, 18: 15833
ERYTHROPOIETIN
effects on iron-59 uptake by rat tibia, 18: 15797
radiation effects on response of mice to, 18: 15833
ESCHERICHIA COLI
proflavine resistance of mutants, 18: 15844
radiation effects on, protective effects of 5-BUDR against, 18: 15898
radiosensitivity gene in, analysis of, 18: 15846
ESTROGENS
labeling with tritium, 18: 16078 (TID-7689(p.46-50))
ETHANOL
ethanol–HCl, sorption by cellulose ion exchangers of metal ions from, 18: 16140
ETHYLENE POLYMERS
neutron scattering at 0.089 to 1.0 ev, cross sections for, 18: 16891(R) (GA-4881)
radiation effects on, temperature dependence of birefringence in, 18: 16098
radioinduced crystallite size changes in, gamma, 18: 16099
radiolysis in presence of nitric and nitrous oxides, yields in, 18: 16093
ETHYLENEDIAMINE COMPLEXES
with cobalt bromo- and chloro-nitrates, effects of gamma pre-irradiation on recoil phenomena in neutron irradiated, 18: 16113
EUROPIUM
reduction of pentaamine-cobalt(III) complexes by, kinetics of, 18: 16018
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from fission products by solvent extraction using D2EHPA, 18: 16147
EUROPIUM COMPLEXES
with dibenzoylmethide, picric acid, and TTA, luminescence decay of, 18: 16089
EUROPIUM FLUORIDES
NH_4F–EuF_3, chemical properties and crystal structure, 18: 16013
EUROPIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
EUROPIUM ISOTOPES Eu-152
movement in soils, Belgian studies on, 18: 17341
EUROPIUM ISOTOPES Eu-153
gamma transitions in, internal conversion coefficients for, 18: 17016
EXCRETION
of tritium-labeled vinblastine by rats, 18: 15790
radiation effects on dog, under high oxygen tension, x, 18: 15880
EXCRETORY SYSTEMS
radiotherapy of leukoplakia of urethra using phosphorus-32 chromic phosphate implantation, 18: 15935
EXOSPHERE
plasma in, analysis by satellite-borne probes, 18: 17191
EXPERIMENTAL BREEDER REACTOR
fuel element monitoring, 18: 17309
EXPERIMENTAL BREEDER REACTOR-II
fuel processing facility for, 18: 16153
EXPERIMENTAL LOW-TEMPERATURE PROCESS HEAT REACTOR
design specifications of, engineering drawings for, 18: 17316
EXPERIMENTAL ORGANIC COOLED REACTOR
modification for increased power generation of fast fuel element in loop in, 18: 17247 (APDA-158)
EXPLODING WIRE PHENOMENA
x-ray emission from hollow exploding wires, mechanisms of, 18: 16566
EXPLOSIONS
quarry blasts on Hanford Reservation, acoustic and seismic measurements during, 18: 17317 (HW-79614)
transverse waves from directed, 18: 17372(T) (UCRL-Trans-992(L))
EXPLOSIVES
electric power production using, MHD systems for, 18: 16743 (MHD-646)
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026
sorptive properties of HMX for trimethylstearylammonium bromide, tracer study of, 18: 16384 (TID-7688(p.31-7))
EYES
radiation effects on moth, beta, 18: 15814 (USNRDL-TR-698)
radiation effects on glycogen content in dog and rabbit, x, 18: 15837(T)
radiodiagnosis and therapy of, protective measures during, 18: 15944
radioinduced cataracts on, analysis of, 18: 15816(T) (CEA-tr-R-1635)

F

FALLOUT
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
distribution prediction for, use of weather radar in, 18: 16202(R) (AD-416645)
effects on Marshall Islanders, 5-year post-exposure survey of, 18: 15843
effects on radiometric field measurements in prospecting for radioactive minerals, 18: 16220
human radiation exposure from, survey, 18: 16212
monitoring by high-altitude balloon flights, San Angelo, Texas and Mildura, Australia, July to September 1963, 18: 16203(R) (NYO-10496)
monitoring in air and milk in Canada, 18: 16229 (NP-13760)
monitoring in France, 1963, 18: 16204(R) (SCPRI(RM)-XII-1963)
monitoring in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
monitoring in Japan, 1963, 18: 16214
monitoring in Mediterranean Sea, 1961 to 1963, 18: 15758(R) (TID-20347)
monitoring in Mediterranean Sea, 1960 to 1963, 18: 15759(R) (TID-20366)
monitoring in Nashville, Tenn., 18: 16232 (TID-18603)
monitoring in New Mexico, 1962 and 1963, 18: 16224(R) (LAMS-3034 (p.180-3))
radiation dose rate from local, effects of radionuclide fractionation on, 18: 16234 (USNRDL-TR-715)
strontium-90 uptake by brown trout from, 18: 16243
FAST REACTORS
burnup of ceramic fuel elements in, 18: 17290(T) (AEC-tr-6359)
control of pulsed, 18: 17325 (NP-13710)
neutron distribution and reactivity of heterogeneous, 18: 17275 (AEEW-R-183)
neutron multigroup constants for, 18: 17287 (NP-13666)
neutron transport in, equations for, 18: 17288
FATTY ACIDS
radiation chemistry of milk, 18: 15848
radiolysis of, electron spin resonance spectra of free radicals in, 18: 16091
separation by reversed-phase chromatography using polymerized cellulose, 18: 16145
FECES
calcium-47 uptake by dog, effects of adrenal steroids on, 18: 15795
collection of, tracer studies in, using lanthanum-140, 18: 15934
FEED MATERIALS
radiation from, monitoring at Feed Materials Production Center in 1963, 18: 16233(R) (TID-20368)
FERMIONS
theory of systems of many, starting from degenerate state, 18: 16800
wave function with pairing correlations for finite systems, 18: 17084
FERROMAGNETIC MATERIALS
Ising model of, analytical method for, 18: 16487(T) (UCRL-Trans-1030(L))
FFAG ACCELERATORS
beam stacking in electron storage rings in MURA, coherent vertical instabilities in, 18: 16594 (BNL-7534(p.368-74))
FIELD THEORY
axiomatic, nuclear potential in, 18: 17050
dispersion relations, solution to N/D equations in, 18: 16813
elementary particle interactions in, Hartree-Fock solution for many-body, 18: 16814
energy partition in cosmical physics, 18: 16815
interactions of bosons as hard spheres in nonrelativistic, 18: 16804
meson coupling in, vector, 18: 16793
Regge-pole description of strong-interaction particle exchanges in, 18: 16748 (BNL-7534(p.81-2))
scattering above 30 Bev in, 18: 16747 (BNL-7534(p.49-80))
scattering matrix analytic regularization and divergences in, 18: 16808
symmetries in quantum, multiplicative, 18: 16803
FILMS
deposition from line and ring vapor sources, tracer studies of, 18: 16000 (TID-7689(p.96-103))
performance of hydrocarbon, for proton elastic interactions in Bev range, 18: 16794

superconducting, millimeter-wave amplification by, 18: 16879
FILTERS
efficiency for removal of oil mist from compressed air, tracer method for measuring, 18: 16388 (TID-7688(p.78-80))
FINNED TUBES
fabrication of herring-bone, 18: 16462(P)
FISH
calcium, strontium, and strontium-90 concentrations in brown trout, 18: 16243
FISSION
book: *Radioactive Transmutation of Nucleic and Atomic Shells*, in Russian, 18: 17096
kinetic energy distributions in, 18: 17100
theory of, statistical, 18: 17100
FISSION PRODUCTS
deposition behavior in out-of-pile loop system, 18: 17351(R) (BMI-1659(Del.))
deposition from gases, correlation of loop data with mathematical models, 18: 17248 (BMI-X-278)
diffusion from uranium carbides, effects of surface area on, 18: 17351(R) (BMI-1659(Del.))
diffusion of gaseous, in unfueled ceramic oxides, 18: 16424(R) (GEMP-270A)
mass distribution of apparatus for measuring, 18: 16338
motion from high-altitude nuclear explosions, 18: 16213
plant metabolism, 18: 15735(R) (ARCRL-10)
retention in thorium breeder reactors, effects of, 18: 17302 (UCRL-7544)
separation by amalgam exchange, radiochemical, 18: 16148
separation by selective sorption on silica gel, 18: 16144
separation from irradiated fuel elements by solvent extraction, radiation effects on, 18: 16143
separation from irradiated fuels by TBP solvent extraction, 18: 16152
separation from waste solutions, development of methods for, 18: 17350
separation of krypton-85 from uranium, methods and plant for, 18: 16136
separation of zirconium-95 from, by solvent extraction using D2EHPA, 18: 16147
solvent partition in D2EHPA-mineral acid systems, 18: 16147
FISSION RECOILS
energy of uranium-233 and -235, 18: 16946 (NP-13654)
FISSIONABLE MATERIAL
interactions of cylinders of, matrix theory for, 18: 16737 (HW-80213)
FISSIUM
fissium–U, refining, 18: 16153
FLAMES
energy transfer mechanisms in, 18: 17213
FLUID FLOW
boiling heat flux in water, effects of induced whorls on crit. 18: 16183(T) (EURAEC-639)
heat transfer in transverse, around tube bundles, 18: 16175 (NP-13712)
heat transfer to two-phase, in heated tubes, 18: 16171 (EURAEC-929)
hydrodynamic instabilities in boiling channel, model studies of, 18: 16180(T) (AEC-tr-6364)
hydromagnetic stability at a fluid velocity discontinuity between compressible fluids, 18: 16564
of gas-solid suspensions in horizontal channel, 18: 16176 (NYO-2930-1)
rate measurement in streams, calibration of tracer technique for, 18: 16391 (TID-7688(p.91-4))
thrust of two-phase, through apertures, 18: 16178(R) (TID-20336)
two-phase, critical heat flux and pressure drop in vertical tubes, 18: 16172 (EURAEC-951)
two-phase, loop and preliminary tests for hydrodynamics studies in, 18: 16170 (EURAEC-896)
two-phase, pressure drops and vacuum fractions in air–water flow on four-rod assembly, 18: 16182(T) (EURAEC-638)
void fraction in two-phase, theoretical analysis of, 18: 16184(T,R) (EURAEC-883)
FLUID FLOW (TURBULENT)
friction factors for isothermal flow through reactor fuel matrices, 18: 17253
FLUID FUEL REACTORS
fuel fabrication for pebble-bed, 18: 17293(P)
FLUIDIZATION
bubble motion in fluidized beds, 18: 16181(T) (AERE-Trans-997)
hydrodynamics of gas-fluidized beds, 18: 16135
FLUIDS
theory of classical, 18: 16569
theory of, diagram expressions for, 18: 16548 (AERE-R-4494)
FLUORIDE VOLATILITY PROCESSES
development of fused-salt, for processing irradiated reactor fuels, 18: 16153
FLUORIDES
corrosive effects on INOR-8 and iron–molybdenum–nickel alloy, 18: 17351(R) (BMI-1659(Del.))
effects of injected, on mineralization of dentin in rat teeth, 18: 15792
FLUORINE
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
radiolysis effects on plutonium hexafluoride, 18: 16076 (ANL-6812)
reactions with cobalt oxide for production of cobalt trifluoride, 18: 17374(T) (UCRL-Trans-1043(L))
FLUORINE IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
FLUORINE ISOTOPES F-18
energy levels of, $\{(d_{5/2})\}$, 18: 16933 (ANL-6848(p.182-7))
preparation by oxygen-16 (t,n) reaction, purification after, 18: 16111
FLUORINE ISOTOPES F-19
alpha reactions with, gamma spectra of sodium-23 from, 18: 17001
energy levels of, 18: 17030
neutron cross sections, Wigner cusps in, 18: 17069
neutron reactions with, cross sections at 13 to 21 Mev, 18: 16969
proton reactions (p,α), fluctuations in cross sections of, 18: 17078
FOG
heat transfer by, 18: 17322(R) (TID-19971)
FOILS
activation of, standardized method for obtaining threshold parameters for fast-neutron, 18: 16367
thermal neutron flux distributions in stacks of, 18: 16901
FOOD
nutritional quality of survival, 18: 16237
radiation effects on rat consumption of, age effects on protons, 18: 15815 (USNRDL-TR-712)
radiation effects on meat, 18: 16381 (NP-13619)
radioactive contamination of raw materials for bread, methods of removing, 18: 15906
radioactive contamination by cesium-137 and strontium-90 migration in soils, 18: 16239
radioactivity of, in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
radiosterilization of barley malt, effects of quality, 18: 15841
radiosterilization of Salmonella-infected, gamma, 18: 15854
FORESTS
cesium-137 uptake and distribution in, 18: 15762
ecology of, effects of Malathion aerial spray on, 18: 17362(R) (TID-20355)
FORMALDEHYDE
atomic electronic states, measurement of dipole moment of excited, 18: 17352 (CONF-417-6)
FORMIC ACID
reactions with uranium(VI) ions, catalytic, 18: 15997 (RT/CHI(63)-32)
FOURMARIERITES
synthesis, 18: 16009
FRANCE
fallout monitoring, 1963, 18: 16204(R) (SCPRI(RM)-XII-1963)
radiation dosimetry practices in, 18: 16267
FREE RADICALS
electron spin resonance spectra of, radioinduced in aliphatic acids and salts, 18: 16091
radioinduced formation in water, 18: 16080
yields in Szilard-Chalmers reactions in cyclohexane with and without iodide, 18: 16112
FURNACES
environment, use of low density inert gas flush in, 18: 16425(R) (NP-13741)

G

GADOLINIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from samarium and ytterbium by zone crystallization in nitrate medium and by precipitation using ammonium oxalate, 18: 16137
separation of promethium from, by lithium amalgam electrolysis, 18: 15945 (LADC-6084)
GADOLINIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505
GADOLINIUM FLUORIDES
$NH_4F–GdF_3$, chemical properties and crystal structure, 18: 16013
GADOLINIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
GADOLINIUM ISOTOPES Gd-152
half life of first excited state of, 18: 16986
GADOLINIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
GAGES
design and performance of alpha-particle, for measuring gas density, gas pressure, and film thickness, 18: 16383 (TID-7688(p.7-13))
development of x-ray attenuation, for measurements of sediments in rivers and streams, 18: 16195 (TID-7689(p.142))
GALAXIES
chronology of, evaluation of techniques for determining, 18: 16639
energy source for radio, theory of, 18: 16636
GALLATES
book: *Anti-Radiation Properties of Gallates*, 18: 15904
GALLIC ACID
esters of, protective effects against radiation injuries, 18: 15896(T) (JPRS-23834)
toxic and pharmacological effects of, 18: 15896(T) (JPRS-23834)
GALLIUM
additive effects on thermoluminescence of potassium chloride, 18: 16083
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
heat capacities at low temperatures, measurement of, 18: 16886
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
GALLIUM ISOTOPES Ga-68
uptake by brain tumors, differential, 18: 15931
GALLIUM ISOTOPES Ga-72
beta decay scheme of, nuclear parameters for, 18: 17012
preparation and properties of, for use as neutron sources, 18: 16379
GAMMA-ABSORPTION ANALYSIS
use for measuring silage density in silos, 18: 16393 (TID-7688(p.106-13))
GAMMA DECAY
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in Russian, 18: 17096
GAMMA RADIATION
attenuation by burnt bricks, 18: 17245
attenuation by shielding materials in space vehicles, 18: 16231 (TID-7689(p.76-80))
chemical effects on hydrocarbons, 18: 16079(T) (CEA-tr-A-1411)
chemical effects on ferrous sulfate of, 18: 16095
chemical effects on hydrocarbons at 20 to 400°C, 18: 16116
chemical effects on mineral oils, 18: 16127(P)
chemical effects on anthracite, 18: 16523 (BM-RI-6391)
detection and measurement of, book on high-sensitivity, 18: 16354
detection and measurement of, devices for, 18: 17033
detection and measurement of low-dose, performance of implanted silver metaphosphate glass detector for, 18: 15811(R) (LAMS-3034(p.133-40))
detection and measurement in man, whole-body, 18: 16300(R) (LAMS-3034 (p.143-61))
detection and measurement by luminescent dosimeters, 18: 16305 (NP-13748)
detection and measurement by military radiacs, effects of operator on energy-directional response, 18: 16309 (USNRDL-TR-701)
dosimetry, problems in personnel, 18: 16364
effects of pre-, on recoil phenomena in neutron irradiated cobalt complexes, 18: 16113
effects of, measurement and shielding, 18: 17375
effects on contact melting of metals, 18: 16538
effects on crystallite size distributions in polyethylenes, 18: 16099
effects on dielectric properties of triglycine sulfate, 18: 16124
effects on electric conductivity of semiconductors, 18: 16541
effects on infrared absorption spectra of sodium nitrite single crystals, 18: 16100
effects on lead nitrate crystals, effects of compression on annealing of, 18: 16103
effects on meat, 18: 16381 (NP-13619)
effects on mechanical properties of selenium oxides, 18: 16542
effects on nuclear emulsion dosimetry of fast neutrons, 18: 16357
effects on rat hemagglutination-inhibiting antibody production, 18: 15820
effects on rat lymphocytes, 18: 15872
effects on *Salmonella typhimurium*, 18: 15854
effects on scintillating plastics, 18: 16366
effects on seignetto salt dielectric properties, 18: 16545
effects on selenium crystallization, 18: 16540
effects on silicon carbide luminescence, 18: 16122
effects on silicon crystals, Hall effect measurements of, 18: 16534
effects on structure of cadmium sulfides, 18: 16125
effects on thermoluminescence of germanium-doped and natural quartz crystals, 18: 16121
effects on tissues, film dosimeter determination of, 18: 16263
effects on Zeolytes, 18: 16118
emission from nuclei, theory of stimulated, 18: 16952 (TID-20313)
emission in de-excitation of compound nuclei, 18: 16951(R) (TID-20311)
emission in lithium-7 (He-3,p) reactions at 14.4 Mev, angular distributions of, 18: 17101
emission in neutron reactions with carbon and oxygen at 14 Mev, spectra of, 18: 16329
emission in neutron reactions (n,γ) with nuclei, dose distributions of, 18: 16962
emission in proton reactions (p,γ) with silicon-30 at 1.00 to 1.53 Mev, angular correlations for, 18: 17080
emission of low-energy, by copper-65 and vanadium-51, 18: 16980
energies of silicon 29 (p,γ), 18: 17059
fading in neutron films, induced, 18: 16359
heating effects on iron slabs, calculation of, 18: 17243 (GAMD-3690)
interaction with electrons, double Compton effect in, 18: 16771
levels in uranium mines and storage sites, 18: 16240
monitoring of, design of halogen Geiger-Mueller counter for, 18: 16312
reactions (γ,n) with oxygen-16 at threshold to 60 Mev, 18: 16943 (IS-676)
recognition response to, in mice, 18: 15811(R) (LAMS-3034(p.133-40))
therapy for oral cancer, effects of, on mouth and jaws, 18: 15921
GAMMA SHIELDING
book: *Problems in Dosimetry and Shielding*, 18: 17246
GAMMA SOURCES
calorimeters for cesium-137, calibration and performance analysis of, 18: 16377(R) (ORNL-TM-515)
uses in determining shielding effectiveness of space vehicles, 18: 16231 (TID-7689(p.76-80))
GAMMA SPECTRA
analysis of complex, multiple regression method for, 18: 16353
analysis of continuous, problems in, 18: 16951(R) (TID-20311)
GAMMA SPECTROMETERS
calibration of Humco II whole-body, for cesium-137 and potassium-40, 18: 16301(R) (LAMS-3034(p.152-61))
description of external-conversion, for low-energy lines, 18: 16320
design and operation of Humco II whole-body, 18: 16300(R) (LAMS-3034 (p.143-51))
design of Cherenkov, 18: 16330
design of scintillation, with fast neutron discrimination, 18: 16329
design with time-of-flight rejection of neutron-induced background, 18: 16315
multiple regression technique for, 18: 16353
potassium-40 contribution to cesium-137 photopeak in sodium iodide

crystal, 18: 16302(R) (LAMS-3034(p.162-7))
GAMMA SPECTROSCOPY
of urine samples, 18: 15989
GAS COOLED REACTORS
coolant flow restrictor design for channels in, 18: 17274(P)
economic evaluation of graphite moderated, long-term, 18: 17306
fuel element loading and unloading in graphite-moderated, 18: 17271(P)
power distribution in graphite-moderated, device for obtaining optimum, 18: 17270(P)
temperature control equipment for, design of automatic, 18: 17308
GAS FLOW
in arc-heated tube, energy transport and flow processes in, 18: 17132
measurement in process lines by tracer method using xenon-133, 18: 16387 (TID-7688(p.76-8))
through wall-constricted d-c arc, experiments and theory of plasma generation by, 18: 17133
GASEOUS IONS
thermodynamic functions of, 18: 16662
van der Waals radii of rare, relation of hydration energies to, 18: 16016
GASES
blast wave in, electron density and continuum radiation behind, 18: 16648 (NP-13739)
charge transfer in ionized dense, 18: 16725
charged particle energy losses in, 18: 16688
conference on ionization phenomena in gases, Paris, July 8-13, 1963, Vol. I, 18: 16689
electron velocity distributions in weakly ionized, 18: 17214
energy of imperfect Bose, ground-state, 18: 16811
energy of ionized, calculations of kinetic and potential, 18: 16662
energy transfer processes in two-temperature, 18: 16549 (ATN-64(9232)-1)
equations for perfect relativistic, 18: 16570
fugacity of, cancellation of cluster integrals in series for, 18: 16572
ideal Bose-Einstein, ground state occupancy in confined, 18: 16810
ion identification in, at low pressures, 18: 16059
kinetics of ortho- and para-hydrogen mixtures, 18: 16047
kinetics of weakly coupled, multi-time-scale formalism in, 18: 16817
models for heterogeneous, 18: 16647 (KAPL-M-CHR-7)
nuclear magnetic resonance in, effects of electric field on, 18: 17065(T)
Ohm's Law changes for weakly ionized, 18: 17107 (JÜL-145-TP)
partition function for fully ionized, 18: 17207
properties of slightly ionized mixtures of, 18: 16062
reactions with solids in fluidized beds, hydrodynamics of, 18: 16135
separation of mixtures of, by centrifugation, 18: 16156(P)
thermodynamic equilibrium in fully ionized, departure from
toxic, pulmonary deposition and retention of inhaled, 18:
GASTROINTESTINAL TRACT
absorption of cobalt-58-labeled vitamin B_{12}, by human, method for measurement of, 18: 15799
function of, tracer studies of, 18: 15934
iodine-131 absorption after thyroid therapy, 18: 15791
protein loss in, tracer study of, 18: 15793
tumor localization in, by differential uptake of phosphorus-32, 18: 15929
GATING SYSTEMS
design of superconductive, with high switching speed and gain, 18: 16290(P)
GEIGER-MUELLER TUBES
design of halogen, for gamma monitoring, 18: 16312
positive ion mobility in discharges in, 18: 16351
GENETICS
karyographic analysis of monkey blood cells, 18: 15738(R) (LAMS-3034 (p.227-34))
radiation hazards in human, survey, 18: 16251
radioinduced sex ratio shifts, x, 18: 15823
radiosensitivity gene in *Escherichia coli*, analysis of, 18: 15846
GEOCHEMISTRY
book: *Principal Characteristics of Uranium Geochemistry*, 18: 16221
of radioactive waste disposal in U. S., 18: 17337
GEOLOGY
book: *Absolute Geochronology of the Quaternary Period*, 18: 16219
book: *Problems in Applied Radiogeology*, 18: 16222
fracturing studies, use of radioactive sand in, 18: 16194 (TID-7689 (p.105-18))
radioisotope movement in earth environment, research in U. S. on, 18: 16207
GEOMAGNETIC FIELDS
charged particle distribution in, 18: 16731(T) (FTD-TT-64-90(p.110-27))
charged particle motion in, in ionospheric E and F layers, 18: 16865
effects on cosmic radiation, 18: 16735
effects on high-latitude ionospheric E layer, 18: 16868
effects on hydromagnetic wave propagation in ionosphere, 18: 16872
electric currents in, distributions of earth-dynamo, 18: 16866
electron densities about the equator of, 18: 16853
electron injection into earth's, by delayed decays of fission products from high-altitude nuclear explosions, 18: 16213
interactions with the ionosphere, review, 18: 16855
interactions with ionosphere, review, 18: 16873
ion diffusion between ionospheric F layers in, at conjugate points, 18: 16870
nuclear explosion effects, 18: 16546 (AWRE-O-87/63)
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580
symmetries in, at high-latitude conjugate stations, 18: 16869
variations at 0.02 to 0.1 cps, at 35°S latitude, 18: 16863
variations in ionospheric F2 region, anomalous, 18: 16854
variations in 1-cps range, at 35°S latitude, 18: 16862
variations near polar caps, diurnal, 18: 16871
variations of, relation to ionospheric variations, 18: 16856
GEOMAGNETIC STORMS
auroral arc minimum latitude during, quiet, 18: 16821
cosmic-particle effects on polar, 18: 16871
effects on ionospheric radio wave propagation, 18: 16844
effects on oblique-incidence ionograms of 1951 to 58, 18: 16837
electric currents in ionosphere and earth during, 18: 16860
ionospheric absorption during, 18: 16734
ionospheric effects of, 18: 16857
ionospheric effects of, in F2 layer, 18: 16858
relations to solar activity, 18: 16842
GEOPHYSICS
of radioactive waste disposal in U. S., 18: 17337
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580
GERMANIUM
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron diffraction in crystals, 18: 16510
performance in photovoltaic cells, 18: 16746
radiation effects on electric conductivity of thin films of, 18: 16532
GERMANIUM ISOTOPES Ge-77
preparation and properties of, for use as neutron sources, 18: 16379
GERMANIUM TELLURIDES
superconductivity in, 18: 16888
GERMANY
strontium-90 content in plants and soil of Eastern, 18: 15909
GIBBERELLIC ACID
effects on nucleic acid synthesis in barley seed, 18: 17361(R) (TID-20353)
GIBBSITES
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
GLASS
adsorption and self-diffusion on, tracer studies of, 18: 16479 (TID-7689 (p.86-9))
decontamination by ultrasonics, 18: 16250
preparation from high-level radioactive wastes for waste disposal, 18: 17332(R) (HW-80526)
GLAUCONITES
neutron emission by, 18: 16209
GLOBULIN
preparation of iodine-124-labeled, 18: 15933
GLOW DISCHARGES
properties of stationary thread, 18: 16558
GLYCEROL
diffusion of sodium chloride in, at 32°C, tracer study of, 18: 15998 (TID-7688(p.52-63))

iron ion diffusion in, Mössbauer spectra effects of, 18: 16044
radiation effects on color of methylene blue solutions in, 18: 16081
GLYCINE
radiolysis using constricted air spark light source, pulse, 18: 16101
GLYCINE SULFATES
radiation effects on dielectric properties of, gamma, 18: 16124
GLYCOGEN
radiation effects on guinea pig liver, x, 18: 15813 (NP-13733)
radiation effects on eye content in dogs and rabbits, x, 18: 15837(T)
GOLD
alpha reactions (α,n) at 42 Mev, angular distributions of neutrons from, 18: 16951(R) (TID-20311)
argon ion large-angle scattering, 18: 16667
neutron flux distributions in stacks of foils of, 18: 16901
photon scattering by, giant resonance effects on elastic, 18: 17040
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
proton fission at 156 Mev, cross sections and distributions from, 18: 17004
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (AI-Trans-38)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
GOLD ALLOYS
Au–Pd, sorptive properties for hydrogen, 18: 17368(T) (AI-Trans-37)
GOLD ISOTOPES Au-197
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
proton reactions with, nucleon cascades from, 18: 16974
GONADS
iodine-131 effects on rabbit, Freedman reaction in, 18: 15821
radiotherapy of carcinoma of, in female, development of radiation nephritis after, 18: 15862
GRAPHITE
crystal structure and thermal expansion of, 18: 16491
crystal-binding effects on reactor physics quantities, 18: 17266
development of fine-grained, for nuclear applications, 18: 16465 (AERE-R-3943)
electric conductivity of, effects of magnetic field and temperature on, 18: 16660
electric conductivity in, effect of magnetic field on oscillatory, 18: 16514
fabrication of high-density bodies of, 18: 16464(P)
neutron emission by, 18: 16209
pore distribution of fine-grained, effects of carbon black and graphite dust on, 18: 16465 (AERE-R-3943)
production and use of pyrolytic and textile form, 18: 16429
properties as thermal-reactor moderator, effects of moderator scattering law on physics of, 18: 17266
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
thermal conductivity of, for use above 3000°F, 18: 16520
Young's modulus to 3000°C, method for measuring, 18: 16186 (WADD-TR-61-72(Vol.XXIII))
GRAPHITE MODERATED REACTORS
economic evaluation of gas cooled, long-term, 18: 17306
fuel element loading and unloading in gas-cooled, 18: 17271(P)
physics of thermal, effects of moderator scattering law on, 18: 17266
power distribution in gas-cooled, device for obtaining optimum, 18: 17270(P)
GREAT BRITAIN
fallout monitoring, 1962, 18: 15735(R) (ARCRL-10)
photographic dosimetry progress in, 18: 16360
radiation dosimetry of personnel in, 18: 16266
radioactivity of foodstuffs in, 1962, 18: 15735(R) (ARCRL-10)
GRIGNARD REAGENTS
reactions with tritiated water, isotope transfer in, 18: 16073
GROUND
waste disposal at shallow depth in, effects of climate on, 18: 17347
GROUND WATERS
analysis for beryllium in oilfield, spectrometric, 18: 15967
GUINEA PIGS
immunological effects of steroid sex hormones in, 18: 15752
radiation effects on immune reactions in, 18: 15825
radiation effects on pleural inflammation induced by Croton oil in, 18: 15877

H

HAFNIUM
corrosion by cesium at 1600°F, role of oxygen in, 18: 16447
determination in minerals and ores, spectral, 18: 15991
effects on oxidation resistance of chromium, 18: 16423(R) (GEMP-197)
separation by solvent extraction using butyl phosphates, 18: 16157(P)
separation from zirconium and other materials by ion exchange, 18: 16155(P)
HAFNIUM CARBIDES
melting temperature, evaluation for space technology, 18: 16521
preparation and properties of, 18: 16498
HAFNIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
HAFNIUM ISOTOPES Hf-176
gyromagnetic ratio, 18: 17095
HAFNIUM ISOTOPES Hf-177
gyromagnetic ratio, 18: 17095
HAFNIUM ISOTOPES Hf-178
gyromagnetic ratio, 18: 17095
HAFNIUM ISOTOPES Hf-179
gyromagnetic ratio, 18: 17095
HAFNIUM ISOTOPES Hf-180
gyromagnetic ratio, 18: 17095
HAFNIUM NITRIDES
preparation and properties of, 18: 16498
HAFNIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
HALLAM POWER REACTOR
operations analysis, March to Sept. 1963, 18: 17300(R) (NAA-SR-9265)
HANDBOOKS AND MANUALS
nuclear constants for reactor design, 18: 17255
on Homogeneous Reactor Test design, 18: 17326 (ORNL-TM-348)
on library cataloging rules and practice at ORNL, 18: 17356 (ORNL-TM-579)
HANFORD PRODUCTION REACTORS
radiation monitoring instrumentation in reactor areas, modification of fixed, 18: 16297 (HW-79027)
testing and irradiation services and facilities, 18: 17318 (HW-SA-3409)
HANFORD WORKS, RICHLAND, WASH.
quarry blasts, acoustic and seismic measurements during, 18: 17317 (HW-79614)
waste discharge to ground, review on program for, 18: 17337
HASTELLOY X
radiation effects on electric and mechanical properties of, 18: 16424(R) (GEMP-270A)
HAYNES 25 ALLOY
vibration of wires of, effects of length on, 18: 16376(R) (MLM-1157)
HEAD
radiation effects on, on response to stimulus of monkeys, 18: 15851
HEALTH PHYSICS
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
monitoring of building and vault after nuclear excursion of critical assembly, 18: 16242
personnel, psychological considerations in selection and training of, 18: 16270
research programs in, 4/62 to 3/63, 18: 16223 (JAERI-5012)
role of state agencies in, 18: 16269
HEART
output studies, using iodine-131- or iodine-132-labeled albumin as tracer and gamma counting, 18: 15925
selenium-75 transfer across pericardium in dogs, 18: 15804
HEAT EXCHANGERS
leak detection in petroleum refinery, using tracers, 18: 16389 (TID-7688 (p.80-3))
HEAT TRANSFER
between parallel plates, by two-temperature gas, 18: 16549 (ATN-64

(9232)-1)
boiling heat flux in water, effects of induced whorls on critical, 18: 16183(T) (EURAEC-639)
burnout heat flux for water, equipment and techniques for measuring, 18: 16184(T,R) (EURAEC-883)
by liquid metals, research progress on, 18: 17322(R) (TID-19971)
by mercury and potassium–sodium alloy in pipes, 18: 16173 (NP-13656)
critical heat flux of steam–water mixtures in round vertical tubes, 18: 16172 (EURAEC-951)
from hot surface to liquid droplet, radiant, 18: 16177(R) (TID-20133)
from liquid metals to pipes, 18: 16174 (NP-13660)
hydrodynamic instabilities in boiling channel, model studies of, 18: 16180(T) (AEC-tr-6364)
in pipe fittings, equations for, 18: 16185
in transverse flow around tube bundles, 18: 16175 (NP-13712)
to steam–water mixtures flowing in heated tubes, 18: 16171 (EURAEC-929)

HEAT TRANSFER SYSTEMS
design of high temperature supercritical water, 18: 16441 (WCAP-2056 (Pt.I))
design of loop for hydrodynamics experiments on two-phase flow, 18: 16170 (EURAEC-896)
development, 18: 17322(R) (TID-19971)
development for boiling burnout studies, 18: 16184(T,R) (EURAEC-883)
operation of potassium–sodium, chemical problems in, 18: 17310
operational experience of high-temperature supercritical pressure water loop, 18: 16179 (WCAP-2056(Pt.II))
research progress on forced-flow boiling, 18: 16177(R) (TID-20133)

HEATERS
characteristics of high-voltage vortex-stabilized arc, for air, 18: 16283

HELIUM
diffusion and distribution in irradiated beryllia, 18: 16424(R) (GEMP-270A)
Doppler effect in rotating plasma of, 18: 17117(R) (NP-13743)
electron capture by, excitation by, 18: 16709
electron drift velocity in, at 300°K and $10 \leq E/P \leq 300$ v/cm-torr, 18: 17220
electron energy decay in afterglow from electric discharges in, 18: 17232
electron reactions in plasma of, at 4.2°K, 18: 17193
energies and wavefunctions for lowest ^1S states of, exponential correlation functions for, 18: 16655
excitation by electric discharges in, 18: 16719
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
interactions of atomic, delta-function model for, 18: 16657
interactions with hydrogen and lithium ions, delta-function model for, 18: 16657
ionization by electron impact, 18: 16695
ionization cross sections of, calculation of, 18: 16661
ionization of, cation and electron effects on secondary, 18: 16677
lithium ion mobility in, at high temperature, 18: 15994 (AD-416506)
luminescent discharges in, coefficient of recombination for, 18: 17236
photoionization using electron synchrotron light source, 18: 16716
plasma of, electron temperature and percentage ionization in, spectroscopic diagnostic technique for, 18: 17177
plasma of, production by magnetic pumping in stellarator, 18: 17156
potassium atomic beam scattering by, 18: 17121(R) (TID-20362)
radiolysis effects on plutonium hexafluoride, 18: 16076 (ANL-6812)

HELIUM IONS
distributions in upper atmosphere, 18: 17191
electron capture by, into excited state, 18: 16705
electron excitation cross sections for 1s-2s and 1s-2p transitions in, 18: 16681
electron recombination with nebular, spectra of, 18: 16631
electron scattering by, cross sections for, 18: 16682
energy levels of nebular, collisional transitions between, 18: 16632
ionization cross sections of, calculation of, 18: 16661
production of molecular, reaction rates for, 18: 16722
properties of, book on, 18: 17097
reactions (He^3,α) with oxygen-16, spectroscopy with, 18: 16907 (ANL-6848(p.8-15))
reactions (He^3,n) with light nuclei, 18: 16935 (ANL-6848(p.199-207))
reactions with gases in flow burner, spectra from, 18: 16719
reactions with lead-206 at 40 Mev, fission mass yield from, 18: 16951(R) (TID-20311)
reactions with Th^{232}, energetics of fission, 18: 17067
stripping processes at 100 to 450 kev, cross sections for, 18: 16712
van der Waals radii of, relation of hydration energy to, 18: 16016

HELIUM ISOTOPES
properties of hyperfragments of, review, 18: 16963

HELIUM ISOTOPES He-3
content in ratio with helium-4 in iron meteorites, 18: 16210
magnetic moment of, meson-exchange contribution to, 18: 17074
reactions (He^3,α) with carbon-12 at 1 to 2 Mev, angular distributions and cross sections of, 18: 16948 (NP-13732)
reactions (He^3,n) with light nuclei, 18: 16935 (ANL-6848(p.199-207))
reactions (He-3,α) with lithium-7, excited states from, 18: 17031
reactions (He-3,α) with sodium-23, energy levels from, 18: 17055
reactions with carbon-12 at 1.8 to 5.4 Mev, 18: 17060
scattering by nuclei, collective states from, 18: 17020

HELIUM ISOTOPES He-4
content in ratio with helium 3 in iron meteorites, 18: 16210

HELIUM ISOTOPES He-6
beta decay of, ionization of lithium from, 18: 16988
production in lithium-6 μ-mesic atom decay, probability rate for, 18: 17087

HEMATOPOIETIC SYSTEM
radiation doses to, bone marrow assessment of, 18: 15847
radiation effects on response of, to hemorrhagic stress in dogs, 18: 15886

HEMORRHAGE
radiation effects on response of hematopoietic system to, in dogs, 18: 15886

HERBICIDES
distribution in soils, 18: 15735(R) (ARCRL-10)

HETEROGENEOUS REACTORS
neutron distribution and reactivity of fast, 18: 17275 (AEEW-R-183)
neutron flux distribution in empty cylindrical channels surrounded by hydrogenous media, 18: 17249 (EIR-60)
reactivity of, formulas for, 18: 17285

HIGH TEMPERATURE SEPARATION PROCESSES
zone melting of metals, effects of electric current on, 18: 17367(T) (AEC-tr-6376)

HISTOLOGY
sample preparation for demonstration of lipid component of arteries, 18: 17373(T) (UCRL-Trans-1033)

HOLMIUM
hyperfine structure parameters, 18: 16516
photon scattering by, giant resonance effects on elastic, 18: 17040
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
thermal capacity at 0.05 to 0.9°K, 18: 16516

HOLMIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505

HOLMIUM FLUORIDES
NH_4F–HoF_x, chemical properties and crystal structure, 18: 16013

HOLMIUM ISOTOPES Ho-165
proton scattering by, coupled-channel analysis of, 18: 16940 (ANL-6848(p.24-9))

HOLMIUM ISOTOPES Ho-166
beta decay of, beta-gamma correlations in, 18: 17011

HOMOGENEOUS REACTOR TEST
design manual, 18: 17326 (ORNL-TM-348)

HORMONES
effects on immunity of steroid sex, 18: 15752
metabolism of adrenocortical and gonadal, production of fever-producing metabolites by, 18: 15755

HUMBOLDT BAY POWER REACTOR
control of, use of pulsed neutron sources for, 18: 17297(R) (GEAP-4388)

HYDRAZINE
monitoring in reactor coolants, engineering drawings of system for, 18: 16288

HYDRIDES
bonding in mono-, discontinuous change in, 18: 16028

HYDROCARBONS
acid alkylation of, tracer studies of, 18: 16067 (TID-7689(p.128-33))
preparation by reactions of Grignard reagent with tritiated water, isotope effects in, 18: 16073
radiochemical cracking of, at 20 to 400°C, 18: 16116
radioinduced transformation of, gamma and neutron, 18: 16079(T) (CEA-tr-A-1411)
use as reactor coolants, 18: 17257(P)
use of films of, for proton elastic interaction analysis in Bev range, 18: 16794
HYDROCHLORIC ACID
determination in uranium solutions by potentiometric titration, 18: 15966
sorption of metal ions from, by cellulose and resin paper ion exchangers, 18: 16139
spectra of pressure induced shifts in deuterated, effects of nondeuterated acid on, 18: 16025
acetone–HCl, sorption by cellulose ion exchangers of metal ions from, 18: 16140
DBBP–hexone–HCl–8-quinolinol, solvent properties for scandium, 18: 16134
ethanol–HCl, sorption by cellulose ion exchangers of metal ions from, 18: 16140
hexone–HCl–8-quinolinol–TOPO, solvent properties for scandium, 18: 16134
HYDRODYNAMICS
instabilities in boiling channel, model studies of, 18: 16180(T) (AEC-tr-6364)
of gas fluidized beds, review on, 18: 16135
HYDROFLUORIC ACID
bonding in, discontinuous change of, 18: 16028
solvent properties for zirconium alloys, 18: 16152
HYDROFLUORINATION
dynamics of fluidized bed, 18: 16135
HYDROGEN
abstraction by methyl radicals, isotope effects in, 18: 16071
argon rearrangement collisions at high energies, 18: 16676
bonding to uranyl nitrate hexahydrate, determination of, 18: 16043(T)
charged particle reactions with, polarization of Lyman alpha particles emitted from, 18: 16714
coupling of atomic, asymptotic exchange, 18: 16669
deuterium exchange between liquid ammonia and gaseous, process and apparatus for, 18: 16406(P)
diffusion and precipitation in zirconium, 18: 16469(R) (EURAEC-821)
diffusion from alpha- and gamma-iron meteorites, 18: 16210
diffusion in gaseous mixtures, 18: 16054
effects on operation of potassium–sodium heat transfer system in Dounreay reactor, 18: 17310
electron and ion collisional-radiative recombination in plasma of, 18: 17184
electron capture by, excitation by, 18: 16709
electron diffusion coefficient and drift speed in, 18: 16724
electron drift velocities in, method of measuring, 18: 16723
electron scattering by, cross sections for elastic, 18: 16690
energies and wavefunctions for lowest ^1S states of, exponential correlation functions for, 18: 16655
energy levels of nebular, collisional transitions between, 18: 16632
energy levels of nebular, populations of highly exited, 18: 16633
energy levels of, proton charge distribution in, 18: 16686
energy transfer processes in two-temperature, 18: 16549 (ATN-64(9232)-1)
equation of state for *para*-, 18: 16654
equation of state and energy for, 18: 16056
exchange between chlorophyll and solvents, location of, 18: 16042(T)
formation of molecular, in gamma radiolysis of water vapor, 18: 16105
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
hydrogen ion collisions with, energy transfer in, 18: 16706
ionization by electron impact, calculations of, 18: 16693
ionization by electron impact, 18: 16695
ionization of excited states of, by electron impact, 18: 16691
ionization of excited, by electric fields, 18: 16709
isotopic exchange with ammonia, 18: 16126(P)
molecular kinetics of mixtures of ortho- and para-, 18: 16047
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
photoionization and absorption cross sections, 18: 16718
plasma flow through transverse magnetic field, 18: 17174
potassium atomic beam scattering by, 18: 17121(R) (TID-20362)
preparation of beams of neutral atomic, 18: 16703
production of atomic beam of, in 2S state, cross sections for, 18: 16704
proton collisions at low energies with atomic, with $2p\sigma$-$2p\pi$ coupling, 18: 16684
proton energy losses in, 18: 16713
proton reactions with atomic, electron capture cross section for, 18: 16675
reactions of beam of atomic, with magnetically confined plasma, cascade excitation processes in, 18: 17194
reactions with hydrogen atoms, spin-change cross sections for, 18: 16678
separation from deuterium by liquefaction and fractionation, 18: 16407(P)
sorption by palladium and gold-palladium alloy, chemical activity following release, 18: 17368(T) (AI-Trans-37)
HYDROGEN COMPOUNDS
analysis of crystalline, neutron-diffraction, 18: 16055
HYDROGEN ION CONCENTRATION
effects on radiation effects on *p*-aminobenzoic acid, 18: 16110
HYDROGEN IONS
binding energy of negative, 18: 16674
conversion of 750-kev, to excited molecules, 18: 16707
distributions in upper atmosphere, 18: 17191
electron capture by, into excited state, 18: 16705
electron detachment from negative, 18: 16683
electron recombination with nebular, spectra of, 18: 16631
electron recombination in plasma, collisional-radiative, 18: 17184
interactions of, delta-function model for, 18: 16657
interactions with atomic helium, delta-function model for, 18: 16657
reactions with argon at high energies, rearrangement, 18: 16676
reactions with hydrogen gas, energy transfer in, 18: 16706
stripping processes at 100 to 450 kev, cross sections for, 18: 16712
HYDROGEN ISOTOPES
properties of hyperfragments of, review, 18: 16963
HYDROGEN PEROXIDES
determination in water, ultraviolet spectrophotometric, 18: 15948 (CEA-2391)
HYDROGEN SULFIDES
electron beam collisions with, emission spectra from, 18: 16700
HYDROGEN SYSTEMS
H–Nb, magnetic susceptibility at 600 to 900°C, 18: 16502
H–Ti, magnetic susceptibility at 600 to 900°C, 18: 16502
HYDROLOGY
radioisotope movement in earth environment, research in U. S. on, 18: 16207
HYDROMAGNETIC WAVES
propagation in cylindrical magnetic field in cold collisionless plasma of uniform density, 18: 17150
propagation in ionosphere, 18: 16872
HYDROQUINONE
stability of clathrate compound with argon, radiation and thermal, 18: 16084
HYDROXYL RADICAL
split from water by electron impact, statistical model for angular momentum for abnormal rotation of, 18: 16024
HYPERFRAGMENTS
binding energies and lifetimes of, review, 18: 16963
production by meson and proton absorption in nuclear emulsion, 18: 16979
production of, mechanisms of, 18: 16552(R) (UCRL-11132)
HYPERONS (Λ)
decay, 18: 16552(R) (UCRL-11132)
decay of, nonleptonic, 18: 16780
magnetic moments of, 18: 16552(R) (UCRL-11132)
properties in hyperfragments, review, 18: 16963
HYPERONS (Λ^0)

decay of, analysis of cascade, 18: 16761 (NIRL/R/56)
decay of, leptonic, 18: 16764 (NP-13731)
HYPERONS (Σ)
interactions with mesons (π), resonances in, 18: 16552(R) (UCRL-11132)
HYPERONS (Σ^-)
decay of, leptonic, 18: 16764 (NP-13731)
decay of, nonleptonic, 18: 16780
HYPERONS (Σ^+)
decay of, nonleptonic, 18: 16780
HYPERONS (Ξ)
decay parameters of, theory for, 18: 16756 (CERN-64-13(Vol.II) (p.75-111))
HYPERONS (Ξ^-)
decay of, nonleptonic, 18: 16780
HYPERONS ($\bar{\Xi}^+$)
decay of, analysis of cascade, 18: 16761 (NIRL/R/56)
HYPOCHLORITES
radioinduced methyl radical formation in methyltrideuteriomethyl-phenylcarbinyl-, deuterium isotope effects and transition state in, 18: 16086

I

ICE
spectra of labeled and unlabeled and their mixtures, infrared, 18: 16021
spectra of labeled and unlabeled, Raman, 18: 16023
spectra of labeled and unlabeled and their mixtures, infrared, 18: 16022
ILLINOIS
leukemia in children in Chicago, 18: 15749
IMMUNE REACTIONS
radiation effects on, in guinea pigs, 18: 15825
radiation effects on, in mice, 18: 15855
radiation effects on enhanced antitoxin response in mice, 18: 15856
radiation effects on response to toxins in mice, 18: 15856
radiation effects on, in rabbits, 18: 15857
radiation effects on, in rabbits, 18: 15881
IMMUNITY
conference on pathology of, 18: 15754
in guinea pigs and rats, effects of steroid sex hormones on, 18: 15752
radiation effects on, of dogs to anthrax, x, 18: 15858
radiation effects on restoration of, by thymus in rats, 18: 15869
radioactive tracer studies of, uses of iodine-125 in, 18: 15916 (TID-7689(p.17-20))
IMMUNIZATION
against *Schistosoma japonicum* in mice and monkeys by inoculation with irradiated larvae, 18: 15890
IMPACT SHOCK
Cherenkov generation by, 18: 16767
Cherenkov generation by, 18: 16768
response of linear lumped spring-mass systems to, graphical methods for, 18: 17360 (TID-18775)
IN-PILE LOOPS
design and operation, 18: 16526 (NP-13663)
INCONEL X
corrosion by cesium at 1600°F, role of oxygen in, 18: 16447
INDEXES
of Lawrence Radiation Laboratory mechanical engineering notes and specifications, 18: 16160 (UCRL-11200(Vol.1))
INDIAN POINT POWER REACTOR
reactivity coefficients, 18: 17312
INDIUM
additive effects on thermoluminescence of potassium chloride, 18: 16083
effects on properties of oxide cathode coating, tracer studies of, 18: 16003 (TID-7689(p.136-7))
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by solvent extraction using butyl phosphates, 18: 16157(P)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
INDIUM ALLOYS
In–Pb, critical fields in superconducting, 18: 16884
In–Sn, radiation effects on contact melting of, 18: 16538
In–Zn, radiation effects on contact melting of, 18: 16538
Sb–In, neutron diffraction in crystals, 18: 16510
Sb–In, response to infrared radiation, 18: 17103 (ARL-64-6)
INDIUM ISOTOPES In-114
separation from fission products by amalgam exchange, radiochemical, 18: 16148
INDIUM ISOTOPES In-115
energy levels, 18: 17056
neutron reactions (n,α) at 14 Mev, alpha spectra from, 18: 17058
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
INDIUM ISOTOPES In-116
preparation and properties of, for use as neutron sources, 18: 16379
5-INDOLOL, 3-(2-AMINOETHYL)-
brain content in rats, behavior effects, 18: 17364 (UCRL-11179)
effects on iodine metabolism in rat thyroid gland, 18: 15789
INDUSTRIAL MANAGEMENT
prediction of error rates for man in man-machine system, 18: 17358 (SC-R-685)
INFECTIONS
of virus, effects on DNA synthesis in x-irradiated tissue culture cells, 18: 15835
radioinduced pneumonitis, in man and rabbits, 18: 15889
INFRARED RADIATION
detection, 18: 17103 (ARL-64-6)
effects on color of methylene blue in glycerol or water, 18: 16081
radiation dosimetry methods, 18: 16260
INOR-8
corrosion by fluorides in Fluoride Volatility Process, 18: 17351(R) (BMI-1659(Del.))
INSECTICIDES
effects of Malathion, on ecology of forest fauna, 18: 17362(R) (TID-20355)
metabolism, 18: 15756
INSECTS
bibliography on, 18: 15756
labeling, 18: 15756
radiation control, 18: 15756
radiation effects on eye response, beta, 18: 15814 (USNRDL-TR-698)
radiation effects on, 18: 15756
INTERMEDIATE REACTORS
neutron multigroup constants for, 18: 17287 (NP-13666)
IODIDES
cyclohexane-iodide, free radical yields in Szilard-Chalmers reactions in, 18: 16112
IODINE
metabolism in adults and children, 18: 15775(R) (LAMS-3034(p.187-200))
metabolism in rat thyroid gland, effects of serotonin on, 18: 15789
separation from air by foam, 18: 16128 (NYO-9324)
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from gas streams, efficiency of absorbers for, 18: 16033
sorption on particulate matter, pilot plant studies on, 18: 16033
thyroid metabolism of, effects of chlordiazepoxide on, in rats, 18: 15787
uptake and thyroid retention in box turtles, tracer studies, 18: 15781 (TID-7689(p.20-2))
IODINE IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
IODINE ISOTOPES I-125
determination by liquid scintillation counting, 18: 15961 (TID-7688 (p.20-1))
determination in clinical applications, evaluation of scintillation detectors for, 18: 15915 (TID-7689(p.15-16))
diagnostic use in children, dose reduction by, 18: 15939
properties for use in immunologic tracer studies, 18: 15916 (TID-7689 (p.17-20))
IODINE ISOTOPES I-127
neutron inelastic scattering at 800 kev, 18: 17039
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
nuclear magnetic resonance spectra in potassium iodide and sodium iodide, gradient-elastic tensor from quadrupole broadening in, 18: 16562

IODINE ISOTOPES I-129
determination by liquid scintillation counting, 18: 15961 (TID-7688 (p.20-1))
IODINE ISOTOPES I-131
absorption by gastrointestinal tract after thyroid therapy, 18: 15791
content in foodstuffs in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
determination in milk, method for, 18: 15959 (SCPRI(S)-94)
diagnostic and therapeutic uses of, dosimetry for, 18: 15941
dose from, from radiodiagnosis in children, 18: 15939
effects of radiation from, on parathyroid function, 18: 15926
effects on rabbit Graafian follicles, Freedman reaction in, 18: 15821
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
monitoring in milk in Canada from fallout, 18: 16229 (NP-13760)
production of, review of methods for, 18: 16398 (JAERI-4027)
separation from fission products by amalgam exchange, radiochemical, 18: 16148
sorption by charcoal from hot off-gas system, 18: 16230 (TID-7688 (p.68-74))
sorption from aqueous solutions, properties of charcoal for, 18: 16377(R) (ORNL-TM-515)
uptake by thyroid, equipment design for study of, 18: 15919
IODINE ISOTOPES I-132
diagnostic use in children, dose reduction by, 18: 15939
ION BEAMS
detection and measurement of neutral component of, by resonance radiation absorption, 18: 16581
ION COMPLEXES
radioinduced, ion pair frequency in, 18: 16109
thermodynamic and structural properties of, 18: 17355(R) (MIT-1965-7)
ION EXCHANGE
for clay mineral studies, 18: 16200
processes in deep-well waste disposal, 18: 17342
ION PAIR PRODUCTION
radioinduced frequency in, in ion clusters, 18: 16109
ION SOURCES
beam formation from plasma sources, 18: 17240
design for neutron generators, 18: 16904
design of lithium, for electrostatic accelerators, 18: 16615
development for fast neutral beam production, 18: 17121(R) (TID-20362)
development of polarized-deuteron, 18: 16617
IONIZATION
conference on ionization phenomena in gases, Paris, July 8-13, 1963, Vol. I, 18: 16689
energy lowering for plasma with different temperatures of particle components, 18: 17208
potentials of, Glockler's equation for, 18: 16680
IONIZATION CHAMBERS
design for in-pile operation, 18: 16740(R) (AD-425231)
design for operation at ion-collection efficiency below 85%, 18: 16370(P)
radiation source for, design of isolated, 18: 16319
IONOSPHERE
composition and properties of, review, 18: 16733
detection of sporadic densification of E layer of, 18: 16868
diffusion of ions between F layers of, at magnetically conjugate points, 18: 16870
disturbances during geomagnetic storms, 18: 16857
disturbances during polar geomagnetic activity, 18: 16871
disturbances in F2 layer of, during geomagnetic storms, 18: 16858
disturbances in F2 layer of, from low-altitude nuclear tests, 18: 16859
disturbances in, causes and effects of solar-origin, 18: 16823
disturbances in, classification of, 18: 16844
disturbances in, diurnal and seasonal variations in Index of Ionospheric Storminess, 18: 16845
disturbances in, solar-flare-induced, 18: 16644
effects of F2 layer on radio wave frequency phase changes, Doppler study of, 18: 16833
effects of magnetic disturbances on oblique-incidence ionograms, 18: 16837
effects of solar disturbances on, conference on, 18: 16822
electric conductivity and currents in, 18: 16866
electric currents in, during geomagnetic agitation, 18: 16860
electron densities in F2 region of, solar effects on, 18: 16643
electron densities in, about the magnetic equator, 18: 16853
electron density above F2 layer of, 18: 16877
electron distributions in E layer, diurnal variations of, 18: 16864
flow of F layer of, effects of neutral air on, 18: 16867
geomagnetic anomaly in F2 region of, 18: 16854
geomagnetic symmetries in, at high latitudes, 18: 16869
hydromagnetic wave propagation in, 18: 16872
interactions with the geomagnetic field, review, 18: 16855
interactions with geomagnetic field, review, 18: 16873
ion distributions in, atomic and molecular, 18: 16848
ion temperatures in, above F2 layer maximum, 18: 16852
model for E and F1 regions of, 18: 16850
perturbations in, movement and properties of, 18: 16874
plasma in, analysis by satellite-borne probes, 18: 17191
propagation of h-f waves in, solar radiation effects on, 18: 16825
properties of D layer of, under solar-proton bombardment, 18: 16642
properties of, conference, 18: 16847
radio wave absorption by, during geomagnetic activity, 18: 16734
radio wave absorption in polar cap, 18: 16824
radio wave absorption during polar cap events in, 12-Mc, 18: 16827
radio wave absorption in D-region of, effects of type IV radio-burst solar flares on, 18: 16834
radio wave backscatter sounding of, effects of sudden disturbances on, 18: 16836
radio wave diagnostics during storms in, backscatter sounding method for, 18: 16835
radio wave polar blackouts in, origins of, 18: 16826
radio wave propagation during polar blackouts in, h-f, 18: 16828
radio wave propagation in, effects of polar blackouts on vlf, 18: 16829
radio wave propagation in, effects of solar disturbances on vlf, 18: 16830
radio wave propagation by F2-layer of, daytime effects on, 18: 16838
radio wave propagation in, solar disturbance effects at low latitudes on 50-Mc, 18: 16839
radio wave propagation during polar cap blackout, 18: 16841
radio wave propagation disturbances in, relation to solar activity, 18: 16842
radio wave propagation in, during high solar activity, 18: 16843
radio wave propagation in, Doppler effects on, 18: 16876
radio wave reflection processes in, effects of solar disturbances on, 18: 16846
radio-wave multiple scattering in, during aurorae, 18: 16875
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580
solar flare effects on D- and E-regions of, 18: 16832
structure and variations of F region of, 18: 16849
temperature variations in F region of, during sunspot cycle, 18: 16851
transport of charge and mass in E and F layers of, 18: 16865
variations of, relation to geomagnetic variations, 18: 16856
IONS
conversion of, to excited neutrals, 18: 16707
detector for neutral, surface-ionization, 18: 17121(R) (TID-20362)
diffusion between ionospheric F layers at magnetically conjugate points, 18: 16870
distributions in ionosphere, 18: 16848
distributions in ionospheric F region, 18: 16849
drift in Wilson chambers, 18: 16335
energies of plasma, analysis of, 18: 17103 (ARL-64-6)
energy and movement exchange with electrons in flowing plasma, 18: 17210
energy losses in Maxwellian plasma, 18: 17211
energy spectra of positive, in r-f plasmoids, 18: 17238
energy transfer with electrons in two-temperature gas, 18: 16549 (ATN-64(9232)-1)
interactions of two-electron, delta-function model for, 18: 16657
ionization efficiency curves for positive and negative, instrument for simultaneous measurement, 18: 16701
mass measurements in gases at low pressures, 18: 16059
mobilities in weakly ionized plasma, 18: 17219
mobility in cathode sheath of electric arc, 18: 17239
mobility of positive, in ionized dense gases, 18: 16725
mobility of positive, in Geiger counter discharges, 18: 16351
movement of positive, through positive space charge sheath of plasmas,

18: 17221
percolation rates of injected, in porous media, 18: 16010
production and use in electric propulsion system, 18: 16559
reactions and scattering of heavy, 18: 16953(R) (TID-20352)
reactions of heavy, charged particle and neutron production in, 18: 16552(R) (UCRL-11132)
recombination with electrons for case of continuous distribution of atomic energy levels, 18: 16726
temperature relaxation rates in strong magnetic field, 18: 17217
temperatures in ionosphere, above F2 layer maximum, 18: 16852

IRIDIUM
neutron flux distributions in stacks of foils of, 18: 16901
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139

IRIDIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)

IRIDIUM ISOTOPES Ir-192
separation from fission products by amalgam exchange, radiochemical, 18: 16148

IRON
content in red giant stars, theory for, 18: 16634
corrosion by aqueous solutions, inhibition by potassium pertechnetate, 18: 16443(T) (ORNL-tr-32)
determination in copper oxide-iron oxide powders, intensity ratio technique for x-ray spectrometric, 18: 15972
determination in petroleum and its products, activation, 18: 15968
determination in pure aluminum by chromatographic separation and activation methods, 18: 15983
diffusion in chromium–iron alloys, tracer studies of, 18: 16474 (NP-13738)
diffusion in chromium, tracer studies of, 18: 16474 (NP-13738)
dislocation twins in, etch-pit studies of, 18: 16471 (EURAEC-978)
electron exchange in aqueous solutions of, relation of proton mobility to mechanism of, 18: 16019
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
magnetic diffuse scattering from, near Curie temperature, 18: 16894(R) (MIT-3031-1)
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
neutron inelastic scattering by, angular distributions for fast, 18: 17048
neutron inelastic scattering by, cross sections for, 18: 16958(T) (NP-tr-1114)
neutron reactions (n,γ) with, dose distributions from, 18: 16962
proton spallation at 730 Mev, cross sections for, 18: 17049
radiation effects on, effects of channeling on, 18: 16537
radioinduced heating in slabs of, calculation of gamma and neutron, 18: 17243 (GAMD-3690)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from D2EHPA solutions, effects of phosphate ions on, 18: 16377(R) (ORNL-TM-515)
silver hyperfine structure constants in, 18: 16954 (UCRL-11143)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
stability of, effects of thermal cycling on, 18: 16492
vibration of wires of, effects of length on, 18: 16376(R) (MLM-1157)

IRON ALLOYS
Be–Fe, extrusion to fine wires, 18: 16451(R) (AD-432273)
Cr–Fe, diffusion of chromium and iron in, tracer studies of, 18: 16474 (NP-13738)
Cr–Fe, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Fe–Ni, thermal neutron magnetic scattering at high temperatures, 18: 16506
Fe–Mn, dislocation twins in, etch-pit studies of, 18: 16471 (EURAEC-978)
Fe–Mn, thermal neutron magnetic scattering at high temperatures, 18: 16506
Fe–Mo–Ni, corrosion by fluorides in Fluoride Volatility Process, 18: 17351(R) (BMI-1659(Del.))
Fe–Nb, fabrication by cold rolling, 18: 17351(R) (BMI-1659(Del.))
Fe–Pd, magnetic structure at low temperatures, 18: 16894(R) (MIT-3031-1)
Fe–Pu, phase diagrams of, 18: 16493
Fe–Rh, effects of low temperature on electric conductivity, 18: 16511
Fe–Ta, pickling and cold rolling, 18: 17351(R) (BMI-1659(Del.))

IRON CHLORIDES
gamma resonant absorption in crystalline and vitreous, 18: 16036

IRON(III) CHLORIDES
isotopic exchange of iron between iron cupferrate and, 18: 16402

IRON IONS
diffusion in glycerine, Mössbauer spectra effects of, 18: 16044
proton reactions with stellar, excitation of spectral lines in, 18: 16635

IRON ISOTOPES
exchange between iron chloride and iron cupferrate, 18: 16402

IRON ISOTOPES Fe-52
proton reactions (p,t) with, T = T_z + 2 states from, 18: 16923 (ANL-6848(p.125-9))

IRON ISOTOPES Fe-54
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17093
deuteron reactions (d,n) at 7 Mev, 18: 16917 (ANL-6848(p.98-103))
proton scattering at 40 Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))

IRON ISOTOPES Fe-55
determination in the presence of iron-59 in biological materials by direct counting, 18: 15980
energy levels of, properties of, 18: 17093
separation from sulfate solutions by electrolytic deposition, 18: 16404

IRON ISOTOPES Fe-56
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
alpha inelastic scattering by, angular correlations in, 18: 16928 (ANL-6848(p.153-8))
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17093
proton inelastic scattering by, excited states from, 18: 17071
proton scattering at 40 Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))

IRON ISOTOPES Fe-57
deuteron reactions (d,d) and (d,p) at 6.6 Mev, angular distributions for, 18: 17093
energy levels of, properties of, 18: 17093
Mössbauer effect of, diffusion broadening of, 18: 16044

IRON ISOTOPES Fe-58
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
energy levels of, properties of, 18: 17093

IRON ISOTOPES Fe-59
determination in the presence of iron-55 in biological materials by direct counting, 18: 15980
gastrointestinal absorption, 18: 15934
uptake by rat tibia, effects of erythropoietin on, 18: 15797

IRON OXIDES
effects on strontium sorption by clay minerals, 18: 17344
CuO–Fe_2O_3, intensity ratio technique for x-ray spectrometric analysis for copper and iron in, 18: 15972

IRON(II) SULFATES
radioinduced oxidation in sulfuric acid, mechanism of, 18: 16095

IRRADIATION FACILITIES
description at Hanford production reactors, 18: 17318 (HW-SA-3409)
description of Ispra-1, 18: 17328
development, 18: 16527(R) (NRL-Memo-1393)

IRRADIATION TECHNIQUES
review of in-pile, 18: 16526 (NP-13663)

ISOMERIC TRANSITION
book: *Radioactive Transmutation of Nucleic and Atomic Shells*, in Russian, 18: 17096

ISOTOPE EFFECTS
in x-ray spectra, 18: 17064(T)

ISOTOPE SEPARATION METHODS

research program on physical, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
ISOTOPES
neutron reactions at 14 Mev for activation analysis, table of data on, 18: 15955 (NP-13761)
separation of, development of recycle gas chromatography methods for, 18: 16400 (TID-7689(p.89-93))
ISOTOPIC EXCHANGE
in reactions of Grignard reagents with tritiated water, 18: 16073
of deuterium between liquid ammonia and hydrogen, 18: 16126(P)
ITALY
fallout monitoring in Mediterranean Sea, 1961 to 1963, 18: 15758(R) (TID-20347)
fallout monitoring in Mediterranean Sea, 1960 to 1963, 18: 15759(R) (TID-20366)

J

JAPAN
atomic bomb effects on mortality in, 18: 15875
fallout monitoring, 1963, 18: 16214
stack disposal at Tokai-mura, diffusion of gaseous waste from, 18: 16226 (NP-13687)
strontium-89 and strontium-90 deposition at selected locations, 1957 to 1961, 18: 16214
JAWS
osteoradionecrosis of, 18: 15921
JETS
flow of two-phase fluid, through apertures, 18: 16178(R) (TID-20336)

K

KAOLINITES
bonding to water, NMR study of, 18: 16031
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
KAOLINS
rubidium-86 absorption and diffusion in, 18: 16199
KEROSENE
kerosene–TBP, analysis for nitric acid and uranium by potentiometric titration, 18: 15966
KIDNEYS
of irradiated kidney cells, 18: 15862
radiation effects on morphology and function of, 18: 15862
radiation effects on dog, under high oxygen tension, x, 18: 15880
radioinduced nephritis, case study of, 18: 15862
KILNS
development for radioactive waste calcination, 18: 17332(R) (HW-80526)
particle residence times in rotary, tracer studies of, 18: 16002 (TID-7689(p.133-6))
KRYPTON
diffusion of hydrogen in, 18: 16054
electron capture by, excitation by, 18: 16709
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ionization by electron impact, 18: 16720
ionization of, Auger effect in, 18: 16698
photon absorption by, cross sections for, 18: 16717
radiolysis effects on plutonium hexafluoride, 18: 16076 (ANL-6812)
KRYPTON IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
KRYPTON ISOTOPES Kr-85
determination, counting methods development for, 18: 16376(R) (MLM-1157)
diffusion in tantalum at high temperatures, 18: 16424(R) (GEMP-270A)
separation from uranium fission products, methods and plant for, 18: 16136
use for leak detection in heat exchangers in petroleum refinery, 18: 16389 (TID-7688(p.80-3))
use for leak detection in Saturn rocket, 18: 16392 (TID-7688(p.95-7))
KRYPTON ISOTOPES Kr-87
preparation and properties of, for use as neutron sources, 18: 16379

L

LA CROSSE BOILING WATER REACTOR
design specifications of, engineering drawings for, 18: 17311
LACTIC ACID, 2-METHYL-
use for chromatographic determination of alkaline earth metals, 18: 16142
LACTOSE
protective effects of acidophilous milk with, against radiation sickness in rats, 18: 15903
LANTHANUM
lanthanum-139 nuclear magnetic relaxation in, 18: 16563
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from samarium by zone crystallization in nitrate medium and by precipitation using ammonium sulfate, 18: 16137
solvent properties in D2EHPA hydrochloric acid, 18: 16147
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
LANTHANUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
LANTHANUM FLUORIDES
NH_4F–LaF_3, chemical properties and crystal structure, 18: 16013
LANTHANUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
LANTHANUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
LANTHANUM ISOTOPES La-139
neutron reactions with, resonances in, 18: 17035
nuclear magnetic relaxation in lanthanum metal, 18: 16563
LANTHANUM ISOTOPES La-140
preparation and properties of, for use as neutron sources, 18: 16379
separation from fission products by amalgam exchange, radiochemical, 18: 16148
LANTHANUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
reduction by aluminum *in vacuo*, 18: 16430
LARVAE
radiation effects on immunity caused by inoculation of mice and monkeys with *Schistosoma japonicum*, 18: 15890
LAURIC ACID
separation from myristic and stearic acids by reversed-phase chromatography using polymerized cellulose, 18: 16145
LEAD
diffusion in liquid cadmium–lead alloys, tracer study of, 18: 16480 (TID-20326)
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
superconductivity of filaments of, in copper matrix, 18: 16878(R) (SSD-TDR-63-98)
viscosity of liquid, 18: 16153
LEAD ALLOYS
Cd–Pb, diffusion of cadmium and lead in liquid, 18: 16480 (TID-20326)
In–Pb, critical fields in superconducting, 18: 16884
Pb–Sn, effects of electric current on purification by solidification, 18: 16428(T) (AEC-tr-6366)
Pb–Sn, zone melting of, effects of electric current on segregation in, 18: 17367(T) (AEC-tr-6376)
LEAD AZIDES
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026

LEAD CHLORIDES
reduction by niobium in fused halides, 18: 16032
LEAD ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
LEAD ISOTOPES Pb-206
determination of ratio to lead-207 in pitchblende and uraninite, relation of geologic age to, 18: 16218
fission of, mass yield from helium-induced, 18: 16951(R) (TID-20311)
LEAD ISOTOPES Pb-207
determination of ratio with lead-206 in pitchblende and uraninite, relation of geologic age to, 18: 16218
LEAD ISOTOPES Pb-208
proton scattering at 40 Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))
LEAD ISOTOPES Pb-210
beta decay parameters, 18: 17094
LEAD NITRATES
radiation damage in, effects of compression on annealing of, 18: 16103
radiation effects on ESR spectra of nitrogen di- and trioxides in, 18: 16087
LEAKS
detection in Saturn rocket, tracer technique for, 18: 16392 (TID-7688 (p.95-7))
LEAVES
strontium uptake by disks of banana, effects of light on, 18: 15798
LECTURES
on beta decay theory, 18: 16760 (LAMS-3013)
LEUKEMIA
effects of, on chromosome count in bone marrow of mice, 18: 15744(R) (LAMS-3034(p.307-11))
incidence in children of Chicago, 18: 15749
radiation effects on Japanese mortality from, from atomic bomb, 18: 15875
radio- and urethan-induced in mice, protective effects of bone marrow against, 18: 15899
radiodiagnosis of chronic myelogenous, by abnormal vitamin B_{12} binding, 18: 15914 (TID-7689(p.11-14))
LEUKOCYTES
radiation effects on chromosomes of human, x, 18: 15840
LIBRARIES
cataloging rules and practice at ORNL, manual, 18: 17356 (ORNL-TM-579)
LIGHT
effects on strontium sorption by banana leaf disks, 18: 15798
emission in electron reactions with silver foils, 18: 16649 (ORNL-3485)
LIGHT SOURCES
design of air spark, for pulse radiolysis, 18: 16101
performance of argon and helium continuum, 18: 16717
LIMONITES
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
LINEAR ACCELERATORS
development and operation, 18: 16552(R) (UCRL-11132)
electron tube for, development of deuterium-filled, 18: 16167
radiotherapeutic use, 18: 15922
LINOLEIC ACID
synthesis of tritium-labeled, chemical method for, 18: 16070
LIPIDS
demonstration of, in microscopic sections of blood vessels, by use of fluorescent dyes, 18: 17373(T) (UCRL-Trans-1033)
radiation effects on guinea pig liver, x, 18: 15813 (NP-13733)
radiation effects on flavor of milk, 18: 15848
LIQUID METAL COOLED REACTORS
thermal insulation for hot and cool coolant tanks in sodium-graphite, 18: 17273(P)
LIQUIDS
Cherenkov emission from, shock-initiated, 18: 16767
Cherenkov emission from, shock-initiated, 18: 16768
electron state density and localization in model for, 18: 16578
models for heterogeneous, 18: 16647 (KAPL-M-CHR-7)
nuclear magnetic resonance in, effects of electric field on, 18: 17065(T)
percolation rates of injected, in porous media, 18: 16010
LITHIUM
corrosive effects of liquid, on plutonium nitride, 18: 17351(R) (BMI-1659(Del.))
effects on nitrogen-14 hyperfine coupling constants in EPR spectra of chloronitrobenzene, 18: 16068
electron spin-orbit coupling constants for 4d and 4f shell, 18: 16664
energies and wavefunctions for lowest ^1S states of, exponential correlation functions for, 18: 16655
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ionization of, following production by helium-6 decay, 18: 16988
nuclear magnetic resonance linewidth in, anomalous, 18: 17077
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
wave functions for atomic, 18: 16671
LITHIUM ALLOYS
Li–Pu, phase diagram of, 18: 16493
LITHIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
LITHIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
LiCl–KCl, solvent properties for niobium, 18: 16032
LITHIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
radiation effects on volume expansion and coloration of, 18: 16107
radioinduced coloration in crystals of, deuteron, 18: 16108
LITHIUM HYDRIDES
bonding in, discontinuous change of, 18: 16028
wave functions for, 18: 16671
LITHIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
LITHIUM IONS
interactions of, delta-function model for, 18: 16657
interactions with atomic helium, delta-function model for, 18: 16657
interactions with hydrogen ions, delta-function model for, 18: 16657
mobility in helium at high temperature, 18: 15994 (AD-416506)
production of, design of source for, 18: 16615
van der Waals radii of, relation of hydration energy to, 18: 16016
LITHIUM ISOTOPES
properties of hyperfragments of, review, 18: 16963
LITHIUM ISOTOPES Li-6
electron inelastic scattering by, form factors for, 18: 17026
energy levels at 4.5 to 5.5 Mev, 18: 17031
ionization of, design of source for, 18: 16615
lithium-6 reactions with, excited final states from, 18: 17005
lithium-6 reactions with, gamma spectra from, 18: 17006
lithium-6 reactions with, excited states from, 18: 17007
lithium-7 reactions on, neutron spectra from, 18: 17009
meson (μ^-) capture by, probability rate for, 18: 17087
neutron reactions (n,t) with, distributions from, 18: 16965
production in proton reactions with nuclei, 18: 16977
proton inelastic scattering by, excited states from, 18: 17070
proton reactions (p,^{3}He^{4}He) with, cross sections for, 18: 17029
proton reactions (p,2p) with, distorted-wave approximation for, 18: 16906 (ANL-6848(p.2-7))
reactions (^{6}Li,α) with lithium-7, spectra from, 18: 17008
uses in salicylate scintillator for neutron detection, 18: 16308 (TID-7689(p.103-5))
LITHIUM ISOTOPES Li-7
electron inelastic scattering by, form factors for, 18: 17026
gamma spectra of, 18: 17006
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
helium nucleus reactions (He^3,p) at 14.4 Mev, gamma emission in, 18: 17101
helium-3 reactions (^{3}He,α) with, excited states from, 18: 17031
ionization of, design of source for, 18: 16615
lithium-6 reactions (^{6}Li,α) with, spectra from, 18: 17008
production in proton reactions with nuclei, 18: 16977
proton inelastic scattering by, excited states from, 18: 17070

reactions on lithium-6, neutron spectra from, 18: 17009
LITTER SIZES
radiation effects on, of mice, 18: 15809(R) (LAMS-3034(p.124-8))
LIVER
effects of implants of fetal, on erythropoiesis in anemic mice, 18: 15743(R) (LAMS-3034(p.279-85))
radiation effects on lipids, proteins, and glycogen in guinea pig, x, 18: 15813 (NP-13733)
radiation effects on subcellular responses in cells of, in tissue culture, 18: 15864
radiation scanning of, using technetium-99m, 18: 15913 (TID-7689(p.1-11))
LUMINESCENCE
emission in solids, review of, 18: 16577
radiation dosimetry methods, 18: 16260
LUMINESCENT DETECTORS
development of activated lithium fluoride, 18: 16303(R) (LAMS-3034 (p.205-23))
response to electrons, gamma rays, and neutrons, energy and rate dependence in, 18: 16305 (NP-13748)
LUNGS
permeability of membranes of, tracer studies, 18: 15747 (TID-7689 (p.52-4))
radioinduced pneumonitis in man and rabbit, 18: 15889
radiosensitivity, 18: 15888
LUTETIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
LUTETIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505
LUTETIUM ISOTOPES Lu-175
gyromagnetic ratio, 18: 17095
LYMPH CELLS
radiation effects on rat, gamma, 18: 15872
transfer of antibodies by, 18: 15825

M

MACHINE TOOLS
wear of, measurement by activation analysis, 18: 16165 (TID-7689(p.137-42))
MAGNESIUM
alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
crystal lattice vibrations of, spectra of, 18: 16891(R) (GA-4881)
deuteron elastic scattering by, nuclear tensor potentials from, 18: 17041
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
separation from calcium and strontium by anion exchange, 18: 16132
separation using α-hydroxyisobutyric acid, chromatographic, 18: 16142
thermal capacity at 50 to 750°K, 18: 16891(R) (GA-4881)
with electron reactions, photon emission from, 18: 16670
MAGNESIUM ALLOYS
Al–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Ba–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Ca–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Ce–Mg, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Mn, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Mn–Nd, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Mn–Nd–Ni, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Nd, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Nd, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Ni, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Th, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Zr, heat resistance, mechanical properties, and recrystallization of, 18: 16496
MAGNESIUM ALUMINATES
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
MAGNESIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
MAGNESIUM CERIUM NITRATES
specific heat at 2 to 25°K, anomalous contribution from ground-state transition, 18: 16574
MAGNESIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
$MgCl_2$–NaCl, solvent properties for niobium, 18: 16032
MAGNESIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
MAGNESIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
MAGNESIUM IONS
spectral line intensities of lithium-like, 18: 17185
use for exchange in clay mineral studies, comparison with calcium and strontium, 18: 16200
van der Waals radii of, relation of hydration energy to, 18: 16016
MAGNESIUM ISOTOPES Mg-24
alpha inelastic scattering by, angular correlations in, 18: 16928 (ANL-6848(p.153-8))
alpha reactions (α,d) with, $(d_{5/2})^2$ and $(f_{7/2})^2$ levels from, 18: 16933 (ANL-6848(p.182-7))
alpha reactions (α,Be^8) at 42 Mev, 18: 16951(R) (TID-20311)
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
deuteron reactions (d,α), sodium-22 energy levels from, 18: 17055
deuteron reactions (d,d' γ) with, gamma-deuteron correlation in, 18: 16922 (ANL-6848(p.123-4))
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
proton reactions (p,t) with, $T = T_z + 2$ states from, 18: 16923 (ANL-6848(p.125-9))
MAGNESIUM ISOTOPES Mg-25
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
production in (n,α) reactions with silicon, 18: 16971
MAGNESIUM ISOTOPES Mg-26
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
deuteron reactions (d,p) at 6 and 10 Mev, 18: 16918 (ANL-6848(p.104-5))
production in (n,α) reactions with silicon, 18: 16971
triton reactions (t,d) at 6 and 10 Mev, 18: 16918 (ANL-6848(p.104-5))
MAGNESIUM ISOTOPES Mg-27
energy levels, 18: 16918 (ANL-6848(p.104-5))
MAGNESIUM LANTHANUM NITRATES
specific heat at 2 to 25°K, 18: 16574
MAGNESIUM OXIDES
diffusion of iodine and rare gases in, 18: 16424(R) (GEMP-270A)
electric properties, 18: 17370(T) (SC-T-64-44)
mechanical properties of single crystals of, at high temperatures, 18: 16472 (HR-64-253)
melting temperature, evaluation for space technology, 18: 16521
thermal conductivity of foams of, for use above 3000°F, 18: 16520
Al_2O_3–CaO–MgO–ZrO_2, phase studies on, 18: 16490
MAGNESIUM PHTHALOCYANINE
spectrum of, evidence of hydrogen bonding to uranyl nitrate hexahydrate from luminescence, 18: 16043(T)

MAGNESIUM SILICATES
melting temperature, evaluation for space technology, 18: 16521
MAGNET COILS
development for GVL-2 magnetic trap, 18: 17116 (NP-13711)
MAGNETIC FIELDS
charged particle distribution in, 18: 16731(T) (FTD-TT-64-90(p.110-27))
charged particle motion in, in circular accelerators, 18: 16612
charged particle motion in, 18: 16553(T) (FTD-TT-64-90(p.80-109))
charged particle motion in, 18: 16554(T) (FTD-TT-64-90(p.128-62))
charged-particle motion in axisymmetric, nonadiabatic, 18: 17169
diffusion of charged particles from plasma decay in, 18: 17227
diffusion of plasma across, Boltzmann moment equations for, 18: 17226
distribution in plasma, 18: 17104 (ARL-250(Pt.II))
effects of interplanetary, on cosmic radiation, 18: 16735
effects on electric conductivity, 18: 16660
effects on energy gap in superconducting films, 18: 16885
effects on etching of quartz, 18: 16535
effects on hydrogen plasma flowing transversely, 18: 17174
effects on magnetic surfaces in Etude Stellarator, 18: 17178
effects on plasma macroscopic stability, 18: 16773
effects on positive column of low-pressure arc discharges in mercury, 18: 17142
measurement in a-c accelerators, design of electron tube for, 18: 16626
paramagnetic spin-spin relaxation in strong, 18: 16046
plasma boundary layer with, calculation of shape of, 18: 17165
plasma bunch motion in toroidal, 18: 17113 (NP-13698)
plasma interactions in transverse, 18: 17115 (NP-13706)
plasma kinetics in, equations for, 18: 17199
plasma oscillations in strong, high-frequency, 18: 17109 (NP-13612)
plasma stream interactions with dipole, cavity formation in, 18: 17149
plasma wave propagation in "spoke-wheel", 18: 17150
shaping by superconducting surfaces, 18: 16604 (BNL-7534(p.449-77))
MAGNETIC MIRROR MACHINES
plasma injection into GVL-2, 18: 17108 (NP-13609)
MAGNETIC MIRRORS
charged particle distribution in, 18: 16731(T) (FTD-TT-64-90(p.110-27))
charged particle motion in, 18: 17125
magnet design for, 18: 17116 (NP-13711)
plasma injection into, 18: 17110 (NP-13623)
MAGNETOHYDRODYNAMIC CELLS
electric power production by explosive-driven, pulsed, 18: 16743 (MHD-646)
performance of, with segmented electrodes, 18: 16741 (BSD-TDR-63-248)
use in steady-flow separation of uranium-235 from hydrogen moderator of gaseous-core rocket reactors, 18: 17323
MAGNETOHYDRODYNAMICS
book: *An Introduction to Plasma Physics*, 18: 17192
flow pattern properties at small magnetic Reynolds number, 18: 16579
hydromagnetic stability at a fluid velocity discontinuity between compressible fluids, 18: 16564
of spherical conductors, 18: 16547 (AD-416626)
plasma flow in one dimension with heat transfer, 18: 17172
shock growth and propagation in magnetogasdynamic flow, 18: 16560
theory, 18: 17107 (JÜL-145-TP)
MAGNETOSPHERE
solar wind flow over, 18: 16629 (AD-430410)
MAGNETS
design of superconducting, with inductive excitation, 18: 16880
uses for bending beams of charged particles, 18: 16627(P)
uses in apparatus for scanning surface with beam of charged particles, 18: 16628(P)
MAIZE
phototropism in, biochemical effects, 18: 17365(T) (AEC-tr-6362)
rubidium-86 uptake by, effects of diffusion on, 18: 15801
MAMMALS
radiation effects on, of heavy charged particles, 18: 15826
radiation effects on cells of, protective effects of natural substances against, 18: 15897
toxic effects of plutonium-239 in, 18: 15786(T) (FTD-TT-63-559)
MAN
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
biological factors affecting maximum permissible body burdens of radioisotopes in, 18: 15908
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
cesium-132 retention in, after intravenous administration, 18: 15764(R) (LAMS-3034(p.21-33))
cesium-137 biological half life in, 18: 15774(R) (LAMS-3034(p.184-6))
development of osteomyelitis of jaws after radiotherapy of oral tumors, 18: 15860
iodine metabolism in adults and children, 18: 15775(R) (LAMS-3034 (p.187-200))
maximum permissible concentrations of strontium-85, strontium-89, and strontium-90 for occupational exposure of, 18: 15907
parathyroid gland function in, with thyroid disease, effects of therapeutic doses of iodine-131 on, 18: 15926
prediction of error rates for, in man-machine system, 18: 17358 (SC-R-685)
radiation effects on leukocyte chromosomes in, x, 18: 15840
radiation effects on sodium ion flux in erythrocytes of, x, 18: 15873
radioisotopes incorporated in, counter for determining, 18: 16244
radiometric analysis of, for cesium-137 and potassium-40, use of Humco II whole-body counter for, 18: 16300(R) (LAMS-3034(p.143-51))
radiotherapy of leukoplakia of urethra using phosphorus-32 chromic phosphate implantation, 18: 15935
thyroid hormone metabolism in children, 18: 15782 (TID-7689(p.22-5))
MANGANESE
content in red giant stars, theory for, 18: 16634
determination in petroleum and its products, activation, 18: 15968
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
MANGANESE ALLOYS
Fe–Mn, dislocation twins in, etch-pit studies of, 18: 16471 (EURAEC-978)
Fe–Mn, thermal neutron magnetic scattering at high temperatures, 18: 16506
Mg–Mn, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mg–Mn–Nd, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Mn–Nd–Ni, effects of plastic deformation on properties and structure of, 18: 16495
MANGANESE ISOTOPES Mn-54
determination in iron meteorite, spectrometric, 18: 15985
metabolism in rats and mice, 18: 15767(R) (LAMS-3034(p.49-52))
MANGANESE ISOTOPES Mn-55
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
MANGANESE ISOTOPES Mn-56
preparation and properties of, for use as neutron sources, 18: 16379
MANGANESE OXALATES
radioinduced crystallization of anhydrous, 18: 16096
MANGANESE OXIDES
magnetic spin correlations in, near Neel temperature, 18: 16894(R) (MIT-3031-1)
MARITIME PRESSURIZED WATER REACTOR
cooling system radioactivities in N.S. *Savannah* during startup and early operation, 18: 17320 (NSEC-72)
MARITIME REACTORS
rules for construction of nuclear-powered merchant vessels, 18: 17321 (RTI/ING(63)-5)
MARSHALL ISLANDS
radiation effects from fallout on intracoral condition of population of, 18: 15843
MASERS (OPTICAL)
beam rotation in plasma, 18: 17103 (ARL-64-6)
MASS SPECTROMETERS
design of ion collecting apparatus for, to prevent secondary emission effects, 18: 16289(P)
design of multiple-dispersion, 18: 16291(P)
MASSACHUSETTS
macroscopic benthic fauna off Cape Cod, 18: 17363 (TID-20363)
MATERIALS TESTING
engineering drawings for stress-strain, of brittle materials, 18: 16187

measurement of Young's modulus, method for, 18: 16186 (WADD-TR-61-72 (Vol.XXIII))
methods for pressure vessel steel welds, evaluation of, 18: 16459(T,R) (EURAEC-962)
MATHEMATICS
Boltzmann's equation solution from inversion by Wild's formula, 18: 16419
canonical invariance in Markovian relaxation processes, 18: 16417
compactification of homogeneous spaces and contraction of Lie groups, 18: 16420
Dirichlet series and Toeplitz forms, 18: 16415
elliptic integrals of first and second kinds, normal, 18: 17354 (IS-639)
formulas for three-dimensional pure rotation group, 18: 16421
Green's function, representations for nonrelativistic Coulomb, 18: 16416
research program in, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
symmetry relation in relaxation dispersions, 18: 16567
transport equation for isotropic scattering of point radiation, Laplace transform solution of, 18: 16796
MATTER
energy of nuclear, ground-state, 18: 16960
MECHANICAL ENGINEERING
notes and specifications issued by Lawrence Radiation Laboratory, index of, 18: 16160 (UCRL-11200(Vol.1))
process start and control procedures, 18: 17357 (SC-DC-64-378)
MECHANICS
cluster expansions in statistical, algebraic structure of, 18: 16412 (CNAEM-14)
partition functions in statistical, analytical method for, 18: 16487(T) (UCRL-Trans-1030(L))
MEDITERRANEAN SEA
fallout monitoring, 1961 to 1963, 18: 15758(R) (TID-20347)
fallout monitoring, 1960 to 1963, 18: 15759(R) (TID-20366)
radioactivity of plankton from, 1961 to 1963, 18: 15758(R) (TID-20347)
radioactivity of plankton from, 1960 to 1963, 18: 15759(R) (TID-20366)
MEMBRANES
permeability of pulmonary, tracer studies of, 18: 15747 (TID-7689(p.52-4))
MEMORY DEVICES
development for multichannel analyzers, 18: 16340
MERCHANT VESSELS
nuclear-powered, rules for construction of, 18: 17321 (RTI/ING(63)-5)
MERCURY
charge transfer cross sections for vapor of, resonant, 18: 16708
determination in biological and organic materials, activation, 18: 15971
electric discharge in, effects of magnetic field on positive column, 18: 17142
heat transfer by, 18: 17322(R) (TID-19971)
heat transfer by, forced-flow boiling, 18: 16177(R) (TID-20133)
heat transfer in transverse flow around tube bundles, 18: 16175 (NP-13712)
heat transfer to copper and steel pipes, 18: 16173 (NP-13656)
ion drift velocity in vapor of, 18: 16061
ionization cross sections of, calculation of, 18: 16661
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
vapor pressure of, correspondence with cesium, potassium, rubidium, and sodium, 18: 16035
vaporization lifetimes and behavior of droplets of, on hot surface, 18: 16177(R) (TID-20133)
MERCURY IONS
mobility, 18: 16061
MERCURY ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
MERCURY ISOTOPES Hg-203
magnetic moment and spin of, measurement of, 18: 17066
separation from fission products by amalgam exchange, radiochemical, 18: 16148
MESIC ATOMS
decay of lithium-6, helium-6 production in, 18: 17087
MESONS
coupling of vector, octet mixing in, 18: 16793
exchange in three-body nuclei, magnetic moment contribution of, 18: 17074
production of vector, 18: 16552(R) (UCRL-11132)
properties of resonance, review, 18: 16770
MESONS (η)
decay, 18: 16552(R) (UCRL-11132)
production in meson (K^-) interactions with deuterons and neutrons at 765 Mev/c, 18: 16783
spin of, isotopic, 18: 16783
MESONS (P^0)
spin, 18: 16792
MESONS (K)
interactions with protons, feasibility of using 600- to 1000-Bev accelerators to study elastic, 18: 16749 (BNL-7534(p.83-7))
MESONS (K^-)
interactions and reactions, 18: 16552(R) (UCRL-11132)
interactions with deuterons and neutrons at 765 Mev/c, mesons (η) production in, 18: 16783
reactions with emulsion nuclei, hyperfragments from, 18: 16979
MESONS (K^+)
decay and interactions, 18: 16552(R) (UCRL-11132)
ratio to mesons ($K + \pi$), 18: 16762 (NP-13694)
MESONS (K_{e3})
decay, 18: 16552(R) (UCRL-11132)
MESONS ($K_{\mu 3}$)
decay and polarization, 18: 16552(R) (UCRL-11132)
MESONS ($K_{\pi 3}$)
interactions with nucleons, Lee model for, 18: 16778
MESONS (μ^-)
capture by lithium-6, probability rate for, 18: 17087
capture rate in oxygen-16, 18: 16552(R) (UCRL-11132)
MESONS (ω)
decay, 18: 16552(R) (UCRL-11132)
production in meson (π^-)-proton interactions at 4 Bev/c, cross sections for, 18: 16774
MESONS (ϕ)
mass of, formula for, 18: 16799
MESONS (π)
interactions, 18: 16552(R) (UCRL-11132)
interactions of, cross sections for nonresonant, 18: 16774
interactions of, helicity amplitudes for, 18: 16781
interactions with protons, feasibility of using 600- to 1000-Bev accelerators to study elastic, 18: 16749 (BNL-7534(p.83-7))
interactions with nucleons, phenomenological phase shift fit for, 18: 16953(R) (TID-20352)
interactions with nucleons at low energies, ($\frac{3}{2}$, $\frac{3}{2}$) resonances in, 18: 16777
interactions with nucleons at high energies, Regge pole formalism for, 18: 16779
interactions with nucleons at low energies, meson (ρ) effects on, 18: 16781
interactions with nucleons, 556-Mev p_{11} resonance, 18: 16791
photoproduction on nucleons, partial wave analysis of, 18: 16798
production in meson (π)-nucleon interactions at high energies, Regge pole formalism for, 18: 16779
production in nucleon interactions at 16 to 2800 Bev, 18: 16775
production in proton reactions with emulsion nuclei at 16 to 2800 Bev, 18: 16775
resonance states of, mass formulas for, 18: 16799
scattering by nuclei, double charge exchange in elastic, 18: 16939 (ANL-6848(p.236-9))
MESONS (π^-)
absorption at rest by light emulsion nuclei, 18: 16978
absorption in freon-propane mixture, cross sections for, 18: 16776
biological effects in mammals, 18: 15826
capture by explosives, thermal initiation theory of spherical hot spots in, 18: 16026
interactions with protons at 4 Bev/c, resonance production in, 18: 16774
interactions with nucleons at 6.1 to 18.1 Bev/c, strange particle production

in, 18: 16776
interactions with protons at 8.5, 12.4, and 18.4 Bev/c, elastic, 18: 16789
interactions with proton, spin of f° resonances in, 18: 16792
reactions with emulsion nuclei, hyperfragments from, 18: 16979
scattering in emulsions, distortion and noise effects on, 18: 16348
MESONS (π^0)
decay of, analysis of cascade, 18: 16761 (NIRL/R/56)
lifetime of, determination of, 18: 17063
photoproduction on complex nuclei, theory of Coulomb, 18: 17063
MESONS (π^+)
interactions with protons at 8.5, 12.4, and 18.4 Bev/c, elastic, 18: 16789
interactions with protons at 3.65 Bev/c, 18: 16790
MESONS (ψ)
mass of, formula for, 18: 16799
MESONS (ρ)
effects on meson (π)-nucleon interactions at low energies, 18: 16781
MESONS (ρ^0)
production in meson (π^-)-proton interactions at 4 Bev/c, cross sections for, 18: 16774
production in meson (π^+)-proton reactions at 3.65 Bev/c, 18: 16790
METABOLISM
of barium-133 and calcium-45 by empryonic chick and rat bone, 18: 15803
of vinca alkaloids by rats, 18: 15790
METALLIC FILMS
deposition of thin, tracer study of vacuum, 18: 16386 (TID-7688(p.40-3))
METALLURGICAL EQUIPMENT
development for testing high-temperature alloys, 18: 16424(R) (GEMP-270A)
furnace using low density inert gas flush, 18: 16425(R) (NP-13741)
METALS
adsorption and self-diffusion on, tracer studies of, 18: 16479 (TID-7689 (p.86-9))
analysis for oxygen, comparison of neutron-activation and vacuum-fusion, 18: 15951(R) (GA-4855)
book: *Corrosion of Metals and Alloys*, 18: 16446
book: *Problems in Metal Physics and Metallography*, 18: 16432
decontamination by ultrasonics, 18: 16250
distillation of, tracer study of vacuum, 18: 16386 (TID-7688(p.40-3))
effects of pretreatment on adherence of ground-coat porcelain enamel and surface roughness of sheets of, 18: 16457(T) (Al-Trans-41)
heat transfer by liquid, to pipes, 18: 16174 (NP-13660)
morphology of interface between liquid and solid, 18: 16005(R) (TID-20354)
purification by melting techniques, 18: 16153
purification by zone melting, effects of electric current on, 18: 17367(T) (AEC-tr-6376)
METEORITES
analysis for cesium and rubidium, activation and mass spectrometric, 18: 15976
analysis of iron, for manganese-54, spectrometric, 18: 15985
diffusion of hydrogen and tritium from alpha- and gamma-iron, 18: 16210
Dirac monopoles in, search for, 18: 16552(R) (UCRL-11132)
METEOROLOGY
effects of climate on ground waste disposal at shallow depth, 18: 17347
nuclear explosion effects, 18: 16546 (AWRE-O-87/63)
METHANE
exchange reactions with deuterium on platinum, ruthenium, and their alloys, catalytic, 18: 16034
methane rearrangement collisions at high energies, 18: 16676
neutron total cross sections of solid, cold, 18: 17081
preparation from water for tritium counting, 18: 16075
methane–oxygen, electron scattering by neutral atoms of slightly ionized, cross sections for, 18: 16702
METHANE, BROMOTRIFLUORO-
CF_3Br–propane, meson (π^-) absorption in, cross section for, 18: 16776
METHANE, DICHLORODIFLUORO-
diffusion of hydrogen in, 18: 16054
METHANE, TRICHLOROFLUORO-
heat transfer by, forced-flow boiling, 18: 16177(R) (TID-20133)
METHANOL
deuterium-hydrogen exchange between chlorophyll and, location of, 18: 16042(T)
cyclohexane–methanol-*d*, vapor pressure, 18: 16066 (NP-13736)
METHYL RADICALS
abstraction reactions of, deuterium isotope effects in, 18: 16071
formation in irradiated methyltrideuteriomethylphenylcarbinyl hypochlorite, deuterium isotope effects and transition state in, 18: 16086
METHYLENE BLUE
adsorption on siliceous minerals, tracer and transmittance studies of, 18: 16193 (TID-7689(p.85-6))
radiation effects on color of glycerol or water solutions of, 18: 16081
MICE
activation of carbon-12, nitrogen-14, and oxygen-16 in, by protons, 18: 15828
aging of, effects of ancestral radiation exposure on, 18: 15808(R) (LAMS-3034(p.116-23))
cesium-137 distribution in tissues of, after chronic exposure, 18: 15766(R) (LAMS-3034(p.41-8))
cesium-137 excretion by, effects of exercise on, 18: 15765(R) (LAMS-3034(p.34-40))
chromosome number in bone marrow of normal and leukemic, 18: 15744(R) (LAMS-3034(p.307-11))
deuterium uptake by, pathologic anatomy of, 18: 15800
effects of ancestral irradiation of, on morphology of bone marrow chromosomes, 18: 15812(R) (LAMS-3034(p.303-6))
genetic effects of ancestral irradiation in, 18: 15810(R) (LAMS-3034 (p.129-32))
immune response of, to gamma-irradiated tubercle bacilli, 18: 15824
immunization of, against *Schistosoma japonicum* by inoculation with irradiated larvae, 18: 15890
manganese-54 metabolism in, 18: 15767(R) (LAMS-3034(p.49-52))
radiation effects on breeding characteristics of, after exposure for 15 generations, 18: 15809(R) (LAMS-3034(p.124-8))
radiation effects of heavy charged particles on skin of, 18: 15827
radiation effects in cerebellum of, 18: 15830
radiation effects on iron-59 metabolism during, erythropoiesis in, 18: 15833
radiation effects on immune response of hyperimmune spleen cells in, 18: 15855
radiation effects on enhanced antitoxin response in, 18: 15856
radiation effects on tuberculosis in, altitude dependence of cosmic, 18: 15882
radiation effects on tubercle bacilli virulence in, cosmic, 18: 15884
radiation effects on embryos of, x, 18: 15891
radiation effects on chromosomes and male sterility in, x, 18: 15893
radioinduced immunizing property of tubercle bacilli in, cosmic, 18: 15883
radiinduced leukemia in urethan-treated, protective effects of bone marrow against, x, 18: 15899
radiosensitivity of, effects of age on, 18: 15807(R) (LAMS-3034(p.112-15))
recognition response to gamma radiation by, 18: 15811(R) (LAMS-3034 (p.133-40))
strontium-85 metabolism in, effects of environmental temperature on, 18: 15770(R) (LAMS-3034(p.65-72))
thyroid physiology in, effects of chlordiazepoxide on, 18: 15788
zirconium-95 metabolism in, 18: 15768(R) (LAMS-3034(p.53-8))
MICROANALYSIS
equipment for light-element, 18: 15986
MICROORGANISMS
morphology, growth, and survival of, in irradiated soils, 18: 15885
MICROSCOPY
sample preparation of monkey blood, 18: 15738(R) (LAMS-3034(p.227-34))
sample preparation for demonstration of lipid component of arteries, 18: 17373(R) (UCRL-Trans-1033)
MICROWAVES
amplification by superconducting films, 18: 16879
attenuation by shock waves at Mach 8 to 12, time dependence of, 18: 16565
emission from plasma in magnetic field, harmonics in, 18: 17147
emission from plasma in magnetic field, harmonics in, 18: 17148
use in plasma diagnostics, 18: 17143

MILK
acidophilous with lactose, protective effects against radiation injuries in rats, 18: 15903
analysis for iodine-131, method for, 18: 15959 (SCPRI(S)-94)
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
consumption in Nashville, Tennessee, relation to cesium-137 body burdens, 18: 16232 (TID-18603)
monitoring for cesium-137, iodine-131, and strontium-89 and -90 in, from fallout, 18: 16229 (NP-13760)
radiation effects on flavor of fats in, 18: 15848
radioactivity of, in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
strontium-90 content of, uptake by infants' bones, 18: 15796
MINERALS
ion exchange study of clay, 18: 16200
neutron emission by, 18: 16209
sorption of methylene blue on siliceous, tracer and transmittance studies of, 18: 16193 (TID-7689(p.85-6))
MINING
of uranium, radiation levels during, 18: 16240
MITOSIS
radioinduced delay in dog erythroblast, x, 18: 15874
MIXER-SETTLERS
design without moving mechanical parts in contact with liquid, 18: 16158(P)
MIXING
frequency response of aqueous systems in, tracer studies of, 18: 16001 (TID-7689(p.126-8))
MOLECULAR BEAMS
detection of weak alkali, by ionization on hot tungsten, 18: 16555 (UCRL-Trans-1031)
velocity distribution in, time-of-flight measurement of atom, 18: 16653(T) (UCRL-Trans-1032)
MOLECULES
ionization of polyatomic, diabatic effect on electron-impact, 18: 16692
MOLYBDENUM
alloying effects on grain size of uranium, 18: 16509
corrosion by liquid cesium, role of oxygen in, 18: 16447
creep and stress-rupture in argon and hydrogen at 1200 to 2400°C, 18: 16424(R) (GEMP-270A)
determination in petroleum and its products, activation, 18: 15968
hardness of annealed and strain-hardened, at 20 to 2500°C, 18: 16518(T)
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
radiation effects on interstitial loops in, 18: 16536
radiation effects on electric and mechanical properties of, 18: 16424(R) (GEMP-270A)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
MOLYBDENUM ALLOYS
creep-rupture of TZM, in hydrogen at 2000 to 2200°C, 18: 16424(R) (GEMP-270A)
Cr–Mo, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Fe–Mo–Ni, corrosion by fluorides in Fluoride Volatility Process, 18: 17351(R) (BMI-1659(Del.))
Mo–Nb–Zr, phase studies on, 18: 16494
Mo–Pu, phase diagrams of, 18: 16493
Mo–Pu–U, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, fabrication and properties for use as fuel element in Rapsodie, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, radiation stability, 18: 17290(T) (AEC-tr-6359)
Mo–Re–W, mechanical properties of, effects of composition on, 18: 16424(R) (GEMP-270A)
Mo–U, corrosion by water at 650°F, alloying effects of platinum on, 18: 16449(P)
MOLYBDENUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
MOLYBDENUM CARBIDES
melting temperature, evaluation for space technology, 18: 16521
MOLYBDENUM ISOTOPES Mo-101
preparation and properties of, for use as neutron sources, 18: 16379
MOLYBDENUM SILICIDES
behavior and stability at 1700 to 2000°C, 18: 16499
decomposition of divalent, into Mo_5Si_3 at 1700 to 2000°C, 18: 16499
MOLYBDENUM STEEL
corrosion by carbon dioxide at 450 to 825°C, 18: 16444
MOLYBDENUM SYSTEMS
Mo–UO_2, preparation, 18: 17351(R) (BMI-1659(Del.))
MONKEYS
blood picture of *Macaca mulatta* and *M. speciosa*, 18: 15773 (LAMS-3034(p.96-102))
body water volume and turnover in *Macaca mulatta* and *M. speciosa*, 18: 15772(R) (LAMS-3034(p.76-80))
chromosone analysis of blood cells of *Macaca mulatta and M. speciosa*, 18: 15738(R) (LAMS-3034(p.227-34))
immunization of, against *Schistosoma japonicum* by inoculation with irradiated larvae, 18: 15890
radiation and age effects on response to training of, 18: 15850
radiation effects on response to stimulus of, 18: 15849
radiation effects on response to stimulus of, 18: 15851
radiation effects on response to stimulus of, 18: 15852
radiation effects on learning performance in, 18: 15853
MONTE CARLO METHOD
equations for, basic, 18: 16410 (CERN-64-13(Vol.I)(p.169-72))
neutron backscattering by plane and spherical reflectors, 18: 16896 (NP-13720)
review, 18: 16409 (CERN-64-13(Vol.I)(p.147-67))
MONTMORILLONITES
bonding to water, NMR study of, 18: 16031
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
MÖSSBAUER EFFECT
detection in crystalline and vitreous ferric chloride, 18: 16036
MOUTH
development of osteomyelitis of jaws after radiotherapy of oral tumors, 18: 15860
radiation effects on, whole-body, 18: 15843
radiotherapy for cancer of, osteoradionecrosis from, 18: 15921
MULLITES
thermal conductivity of, for use above 3000°F, 18: 16520
MULTIPLICATION FACTOR
calculation of, formulas for, 18: 17285
derivation in cylindrical symmetry, 18: 17282(T) (CEA-tr-X-319)
experimental determination of β^{eff}/l, 18: 17284
MUSCLES
calcium, strontium, and strontium-90 concentrations in brown trout, 18: 16243
MUTATIONS
effects on ultraviolet and proflavine resistance in *E. coli*, 18: 15844
genetic codes in, 18: 15805
mutagenic effects of chemisterilants on *Neurospora crassa*, 18: 15868
of *E. coli* radiosensitivity gene, 18: 15846
radioinduced Saccharomyces cytoplasmic, effects on reactivation, 18: 15819(T) (UCRL-Trans-1029)
MYRISTIC ACID
separation from lauric and stearic acids by reversed-phase chromatography using polymerized cellulose, 18: 16145

N

NAPHTHALENE
methyl-, use of, in liquid scintillation, 18: 16375(P)
NAPHTHALENES
methyl-, preparation and properties for use in liquid scintillators, 18: 16317
NATIONAL REACTOR TESTING STATION
radioisotope migration and retention in lithosphere at, 18: 17349
NATURAL WATERS
radium-226 content of Australian, 18: 16211
soil content of, effects of neutron meter access tubes on, 18: 16201
strontium-90 removal from, device for, 18: 16249
NEBULAE
spectra of, recombination, 18: 16631

spectra of, recombination, 18: 16632
spectra of, recombination, 18: 16633
NEODYMIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from erbium by zone crystallization in nitrate medium and by precipitation using ammonium sulfate, 18: 16137
NEODYMIUM ALLOYS
Mg–Mn–Nd, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Mn–Nd–Ni, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Nd, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Nd, heat resistance, mechanical properties, and recrystallization of, 18: 16496
NEODYMIUM FLUORIDES
$NH_4F–NdF_3$, chemical properties and crystal structure, 18: 16013
NEODYMIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
NEODYMIUM ISOTOPES Nd-143
neutron reactions with, resonances in, 18: 17035
neutron reactions with, radiation widths for resonance, 18: 17036
NEODYMIUM ISOTOPES Nd-144
energy levels and gamma spectra of, 18: 17013
NEODYMIUM ISOTOPES Nd-145
neutron reactions with, resonances in, 18: 17035
neutron reactions with, radiation widths for resonance, 18: 17036
NEODYMIUM ISOTOPES Nd-151
preparation and properties of, for use as neutron sources, 18: 16379
NEON
effects on ionization and power loss in theta-pinch plasma, 18: 17167
electron capture by, excitation by, 18: 16709
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ionization by fission products, 18: 16740(R) (AD-425231)
ionization cross sections of, calculation of, 18: 16661
ionization potential (+6), 18: 16680
potassium atomic beam scattering by, 18: 17121(R) (TID-20362)
NEON IONS
ionization cross sections of, calculation of, 18: 16661
production of molecular, reaction rates for, 18: 16722
spectral line intensities of lithium-like, 18: 17185
sputtering on copper, focusing model for, 18: 16672
sputtering on copper at 20 kev, temperature dependence of, 18: 16673
stripping processes at 100 to 450 kev, cross sections for, 18: 16712
van der Waals radii of, relation of hydration energy to, 18: 16016
NEON ISOTOPES Ne-20
alpha reactions (α,d) with, $(d_{5/2})^2$ and $(f_{7/2})^2$ levels from, 18: 16933 (ANL-6848(p.182-7))
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
proton reactions (p,t) with, $T = T_z + 2$ states from, 18: 16923 (ANL-6848(p.125-9))
reactions with bromine and silver nuclei, models for, 18: 17010
NEON ISOTOPES Ne-21
alpha reactions (α,n), neutron production in, 18: 17055
proton reactions (p,γ), sodium-22 energy levels from, 18: 17055
NEPTUNIUM
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
NEPTUNIUM COMPOUNDS
properties of, review of, 18: 16051
NEPTUNIUM ISOTOPES Np-237
neutron reactions (n,f), cross sections for, 18: 16947 (NP-13661)
NERVOUS SYSTEM
radiation effects on rat, x, 18: 15836(T)
surgical techniques for, anterolateral cordotomy, 18: 15734(R) (ACRH-20(p.37-46))
NEUROSPORA
mutagenic and toxic effects of chemisterilants on, 18: 15868
NEUTRINOS
detection of, review of equipment for, 18: 16326
interactions with neutrons and protons, use of 1000-Bev accelerator to study, 18: 16750 (BNL-7534(p.88-106))
interactions with neutrons, theory for elastic, 18: 16759 (CERN-64-13 (Vol.III)(p.81-110))
interactions with electrons, cross sections for elastic, 18: 16760 (LAMS-3013)
theory for two kinds of, 18: 16782
NEUTRON ACTIVATION CROSS SECTIONS
for nuclei ($A \geq 100$), 18: 17099
NEUTRON BEAMS
modulation of (d,t)-produced, with 5 Mc/sec repetition rate, 18: 16614
production of 14-Mev polarized, generator for, 18: 16902
NEUTRON CROSS SECTIONS
tables, 18: 17255
tables, 18: 17287 (NP-13666)
NEUTRON-DIFFRACTION ANALYSIS
equipment for, 18: 16352
impurity effects in, 18: 16434
methods for hydrogen-bonded crystals, 18: 16055
research programs on, at MIT in 1963, 18: 16894(R) (MIT-3031-1)
NEUTRON PHOTOGRAPHY
fading in, gamma-induced, 18: 16359
NEUTRON SHIELDING
book: *Problems in Dosimetry and Shielding*, 18: 17246
NEUTRON SOURCES
description of polarized 14-Mev, using D-T reaction, 18: 16902
emission strength analyses for, 18: 16376(R) (MLM-1157)
fluxes in paraffin, 18: 16892 (JUL-140-RX)
intensity of, methods of increasing, 18: 16957(T) (AEC-tr-6371)
ion sources for, 18: 16904
use of gamma emitters as, preparation and survey of, 18: 16379
use of pulsed, in startup of power reactors, 18: 17297(R) (GEAP-4388)
NEUTRON SPECTRA
measurement by foil techniques, threshold parameters for, 18: 16367
NEUTRON SPECTROMETERS
calibration by nuclear emulsions, 18: 16358
description of time-of-flight, for D-D neutrons, 18: 16323
design and operation of, 18: 16352
NEUTRONS
absorption by uranium, transport theory calculations of thermal utilization in, 18: 16955 (ZFK-TPH-1)
absorption of, theory of resonance, 18: 16895 (NP-13662)
chemical effects on hydrocarbons, 18: 16079(T) (CEA-tr-A-1411)
cross sections, 18: 17287 (NP-13666)
cross sections for, 18: 17255
detection and measurement using Hurst proportional detector, multisphere instrument, and single-sphere instrument, 18: 16299 (LAMS-2977)
detection and measurement by luminescent dosimeters, 18: 16305 (NP-13748)
detection and measurement of, using lithium-6 salicylate scintillator, 18: 16308 (TID-7689(p.103-5))
diffraction by ideal crystals, 18: 16510
diffusion in reactors, program for few-group two-dimensional, 18: 17280 (WCAP-6059)
diffusion in reactors, solution of spatio-temporal equations for, 18: 16890 (EUR-596.e)
diffusion of, program for few-group constants in, 18: 16893 (KAPL-M-6119)
dosimetry by activation techniques, 18: 16355
effects of, measurement and shielding, 18: 17375
effects on ammonium and potassium dichromates, effects of radiation, thermal, and uv annealing on, 18: 16114
effects on cobalt complexes, effects of gamma pre-irradiation on recoil phenomena in, 18: 16113
effects on contact melting of metals, 18: 16538
effects on electric conductivity of thin germanium films, 18: 16532
effects on interstitial loops in molybdenum, 18: 16536
effects on mechanical properties of steels and zirconium alloys, 18: 16525 (NP-13657)
effects on metals at low temperatures, saturation phenomena in defect production in, 18: 16531(T) (AI-Trans-38)
effects on silicon carbide luminescence, 18: 16122

effects on silicon crystals, Hall effect measurements of, 18: 16534
effects on stress-strain curves of copper single crystals, 18: 16530(T) (AEC-tr-6373)
effects on structural properties of steels, 18: 16527(R) (NRL-Memo-1393)
effects on uniform silicon avalanche diodes, 18: 16528 (SC-DC-64-346)
emission in minerals, rocks, and uranium, 18: 16209
emission in rupture of uranium neucleus, 18: 16957(T) (AEC-tr-6371)
flux densities in lattice cells, boundary conditions for gap geometry, 18: 17256
flux distribution in semi-infinite medium with anisotropic scattering and absorption, Milne problem for, 18: 16900(T)
flux distributions in concentric fuel annuli, one-group collision-probability calculations for, 18: 17252
flux distributions within certain energy spectra, theory for defining, 18: 16903
fluxes in paraffin containing beryllium–carbon–radium source, 18: 16892 (JUL-140-RX)
heating effects on iron slabs, calculation of, 18: 17243 (GAMD-3690)
interactions with accelerator beams using neutron-gas targets, 18: 16600 (BNL-7534(p.406-13))
interactions with neutrinos, use of 1000-Bev accelerator to study, 18: 16750 (BNL-7534(p.88-106))
interactions with neutrinos, theory for elastic, 18: 16759 (CERN-64-13(Vol.III)(p.81-110))
interactions with mesons (K^-) at 765 Mev/c, mesons (η) production in, 18: 16783
meter access tubes, effects on soil temperature and water, 18: 16201
multiplication in paraffin–uranium fluoride systems, 18: 16891(R) (GA-4881)
photoemission from oxygen-16 at threshold to 60 Mev, cross sections and resonances in, 18: 16943 (IS-676)
polarization in carbon-12 (d,n) reactions, 18: 16908 (ANL-6848(p.16-23))
polarization in tritium (p,n) reactions at 1.9 to 3.5 Mev, 18: 17052
production in stars, 18: 17055
production of polarized, in (d,n) reaction on deuterium, 18: 16992
properties of, book on, 18: 17097
reactions (n,α) with silicon-29, nuclear properties from, 18: 16995
reactions (n,α) at 14 Mev, statistical analysis of excitation functions and energy spectra, 18: 17057
reactions (n,α) at 14 Mev, statistical model cross sections for, 18: 17058
reactions (n,γ) with nuclei, dose distributions from, 18: 16962
reactions of, cross sections for, 18: 16947 (NP-13661)
reactions with carbon and oxygen at 14 Mev, gamma spectra from, 18: 16329
reactions with plutonium-239 at 0.06 to 0.3 ev, cross sections for fission, 18: 17002
reactions with uranium-233 and -235, kinetic energy of fragments from fission, 18: 16946 (NP-13654)
scattering by crystals, research programs on, 18: 16894(R) (MIT-3031-1)
scattering by ethylene polymers at 0.089 to 1.0 ev cross sections for, 18: 16891(R) (GA-4881)
scattering by iron, nickel and niobium at 0.6 to 2.4 Mev, 18: 16958(T) (NP-tr-1114)
scattering by nuclei at 0.3 Mev, angular distributions for elastic, 18: 17090
scattering cross sections for, resonance structure in, 18: 16941 (ANL-6848(p.241-8))
scattering laws for graphite moderators of thermal reactors, 18: 17266
scattering of, energy transfer matrices for anisotropic elastic, 18: 16897 (UCRL-7624)
scattering on nuclei at 0.65 Mev, angular distributions for elastic, 18: 17089
spectra of, from lithium-7 reactions on lithium-6, 18: 17009
transfer in reactions, reduced widths from, 18: 16929 (ANL-6848(p.160-7))
transport in fast reactors, equation for, 18: 17288
transport theory of, derivation of some invariant imbedding equations in, 18: 16898
transport theory of, correction to invariant imbedding equations obtained by particle counting in, 18: 16899

NEUTRONS, COLD

interactions with bound protons at low temperatures, total cross sections for, 18: 17081
scattering by hydrogenous compounds at low temperatures, total cross sections for, 18: 17081

NEUTRONS, FAST

angular distributions from alpha bombardments, carbon-12 detectors for, 18: 16951(R) (TID-20311)
attenuation by water, flux profiles for, 18: 16891(R) (GA-4881)
cross sections, 18: 17287 (NP-13666)
dosimetry using nuclear emulsions, 18: 16357
effects on mechanical properties of Type 347 stainless steel, 18: 17351(R) (BMI-1659(Del.))
flux measurement by phosphorus and sulfur activation, 18: 16356
flux measurement, counter for, 18: 16362
gamma radiation effects on nuclear emulsion dosimetry of, 18: 16357
production of 14-Mev polarized, generator for, 18: 16902
reactions (n,α) with silicon at 13.6 to 15 Mev, cross sections for, 18: 16971
reactions (n,t) with lithium-6, distributions from, 18: 16965
reactions on beryllium, cross sections for inelastic, 18: 16966
reactions on nickel at 175 to 300 kev, total cross sections, 18: 17038
reactions on sodium, thorium, and uranium, cross sections for, 18: 16973
reactions with fluorine-19 and sodium-23, cross sections, 18: 16969
reactions with isotopes for activation analysis, table of data on, 18: 15955 (NP-13761)
reactions with nuclei at 12.5 to 21 Mev, cross sections for, 18: 16970
reactions with rhodium-103, strength functions from, 18: 17032
scattering by carbon-12, excitation of 7.65-Mev level by, 18: 16967
scattering by carbon-12, excited states from inelastic, 18: 16968
scattering by deuterium, elastic, 18: 16964
scattering by iodine-127 at 800 kev, inelastic, 18: 17039
scattering by iron, angular distribution for inelastic, 18: 17048
scattering by plane and spherical reflectors, back-, 18: 16896 (NP-13720)
scattering by sulfur-32, distributions from inelastic, 18: 16972

NEUTRONS, FISSION

spectrometric calibration of, by nuclear emulsions, 18: 16358

NEUTRONS, PROMPT

emission in uranium-233 and -235 fission, 18: 16946 (NP-13654)

NEUTRONS, RESONANCE

reactions with cobalt and rare earth isotopes, 18: 17035
reactions with nuclei, radiation widths for, 18: 17033
reactions with nuclei, radiation widths for, 18: 17036
reactions with samarium-149 at 0.1 to 0.9 ev, 18: 17037
reactions with spin-½ nuclei, scattering widths for, 18: 17034

NEUTRONS, THERMAL

density and temperature distributions in reactor, theoretical studies of, 18: 16903
detection and measurement from reactor, apparatus for, 18: 16371(P)
detection of, corona discharge detectors for, 18: 16328
flux distributions inside stacks of foils, 18: 16901
flux in empty cylindrical channels surrounded by hydrogenous media, 18: 17249 (EIR-60)
reactions with uranium-235, energy balance for ternary fission, 18: 17003
reactions with uranium-235, fragment mass distributions from, 18: 16338
scattering by asymmetrically deformed square well potential, S-wave strength function in, 18: 16956 (ZFK-TPH-7)
scattering by chromium–iron–nickel and iron–manganese alloys at high temperatures, 18: 16506

NEW MEXICO

fallout monitoring, 1962 and 1963, 18: 16224(R) (LAMS-3034(p.180-3))

NICHROME

vibration of wires of, effects of length on, 18: 16376(R) (MLM-1157)

NICKEL

alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
catalytic deuteration of alkyl benzenes on, mechanisms of π-complexes in, 18: 16040
content in red giant stars, theory for, 18: 16634
determination in petroleum and its products, activation, 18: 15968
deuteron elastic scattering by, nuclear tensor potentials from, 18: 17041
electronic work function of cesium-coated, 18: 16742(R) (GA-4804)

Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
neutron inelastic scattering by, cross sections for, 18: 16958(T) (NP-tr-1114)
neutron reactions (n,γ) with, dose distributions from, 18: 16962
neutron total cross sections at 175 to 300 kev, 18: 17038
properties as threshold detector, 18: 17278 (KAPL-M-6101)
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (AI-Trans-38)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
silver hyperfine structure constants in, 18: 16954 (UCRL-11143)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
stability of, effects of thermal cycling on, 18: 16492

NICKEL ALLOYS
Cr–Fe–Ni, thermal neutron magnetic scattering at high temperatures, 18: 16506
Fe–Mo–Ni, corrosion by fluorides in Fluoride Volatility Process, 18: 17351(R) (BMI-1659(Del.))
Mg–Mn–Nd–Ni, effects of plastic deformation on properties and structure of, 18: 16495
Mg–Ni, heat resistance, mechanical properties, and recrystallization of, 18: 16496

NICKEL ISOTOPES Ni-58
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
alpha scattering at 28.5 Mev, nuclear states from, 18: 17046
deuteron reactions (d,n) at 7 Mev, 18: 16917 (ANL-6848(p.98-103))
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
proton scattering at 40 Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))

NICKEL ISOTOPES Ni-60
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
alpha scattering at 28.5 Mev, nuclear states from, 18: 17046
proton scattering at 40 Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))

NICKEL ISOTOPES Ni-62
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)

NICKEL ISOTOPES Ni-64
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))

NICKEL OXIDES
melting temperature, evaluation for space technology, 18: 16521

NICKEL STEEL
corrosion by carbon dioxide at 450 to 825°C, 18: 16444

NIOBIUM
alloying effects on grain size of uranium, 18: 16509
alpha reactions (α,n) and (α,p) at 42 Mev, angular distributions of neutrons and protons from, 18: 16951(R) (TID-20311)
compatibility with plutonium carbide–uranium carbide systems at 1500°F, 18: 16426(R) (UNC-5068)
corrosion by liquid cesium, role of oxygen in, 18: 16447
critical current behavior in superconducting, 18: 16883
determination in niobium-tin coated metal ribbon, intensity ratio technique for x ray spectrometric, 18: 15972
dissolution in fused halides, formation of niobium chlorides by, 18: 16032
neutron inelastic scattering by, cross sections for, 18: 16958(T) (NP-tr-1114)
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
reduction of lead and silver chlorides in fused halides, 18: 16032
separation by solvent extraction using butyl phosphates, 18: 16157(P)
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from other fission products by sorption on silica gel, 18: 16144

NIOBIUM ALLOYS
Fe–Nb, fabrication by cold rolling, 18: 17351(R) (BMI-1659(Del.))
Mo–Nb–Zr, phase studies on, 18: 16494
Nb–Sn, intensity ratio technique for x-ray spectrometric analysis, 18: 15972
Nb–Sn, use in accelerators and storage rings as superconductors, 18: 16602 (BNL-7534(p.417-47))
Nb–Ti, formation and aging characteristics of α-martensitic phase in quenched, 18: 16508
Nb–W–Zr, phase studies on, 18: 16494
Nb–Zr, compatibility with plutonium carbide–uranium carbide systems at 1500°F, 18: 16426(R) (UNC-5068)
Nb–Zr, corrosion by liquid cesium, role of oxygen in, 18: 16447
Nb–Zr, production by fused salt electrolysis in sodium chloride–sodium fluoniobate–zirconium tetrafluoride, 18: 16431
Nb–Zr, use in accelerators and storage rings as superconductors, 18: 16602 (BNL-7534(p.417-47))

NIOBIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521

NIOBIUM CARBIDES
bonding and vacancies in, 18: 16483(T) (AEC-tr-6374)
crystal structure, 18: 16507
melting temperature, evaluation for space technology, 18: 16521
preparation and properties of, 18: 16498
preparation of thin films of, 18: 16507

NIOBIUM CHLORIDES
formation by niobium dissolution in fused halides, 18: 16032

NIOBIUM COBALTATES
ion magnetic exchange interactions in, 18: 16048

NIOBIUM ISOTOPES Nb-93
neutron reactions (n,α) at 14 Mev, 18: 17057

NIOBIUM ISOTOPES Nb-95
separation from fission products by amalgam exchange, radiochemical, 18: 16148

NIOBIUM MANGANATES
ion magnetic exchange interactions in, 18: 16048

NIOBIUM NITRIDES
preparation and properties of, 18: 16498

NIOBIUM SYSTEMS
H–Nb, magnetic susceptibility at 600 to 900°C, 18: 16502
Nb–Ta, superconductivity of, time effects in, 18: 16881

NITRATE COMPLEXES
with uranium, spectra of, 18: 16029

NITRIC ACID
corrosive effects on stainless steel, 18: 16152
determination in kerosene–TBP solutions by potentiometric titration, 18: 15966
determination in uranium solutions by potentiometric titration, 18: 15966
properties for separation of aluminum from D2EHPA, 18: 16377(R) (ORNL-TM-515)
separation of ruthenium from, properties of TBP for, 18: 16377(R) (ORNL-TM-515)

NITRIDES
bibliography on properties of refractory, 18: 16481 (UCRL-7559)

NITROGEN
effects on ionization and power loss in theta-pinch plasma, 18: 17167
effects on operation of potassium–sodium heat transfer system in Dounreay reactor, 18: 17310
effects on phosphorus uptake by banana leaf disks, effects of light on, 18: 15798
effects on Zircaloy-2 corrosion and hydrogen pickup in steam and water, 18: 16440 (WAPD-283)
electric discharge in, pinch dynamics of sinusoidally time-dependent currents in, 18: 17160
electric discharges in, effects of electron temperature on dissociation in, 18: 17098
electric discharge in, electron density and collision frequency in afterglow, 18: 17141
electron diffusion coefficient and drift speed in, 18: 16724
electron scattering by, vibrational excitation in, 18: 16699
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656

ion drift velocity in, 18: 16060
ionization by electron impact, 18: 16720
photoionization and absorption cross sections, 18: 16718
plasma of, spectra of continuum radiation from arc-heated, 18: 17135
proton energy losses in, 18: 16713
proton reactions at 220 Mev, cross sections for beryllium-10 production of, 18: 17049
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
spectra excitation by products from electric discharge in helium, 18: 16719

NITROGEN IONS
mobilities of atomic and molecular, 18: 16058
mobilities of, in electric field of 1 to 4 volts/cm, 18: 16057
mobility, 18: 16060
spectral line intensities of lithium-like, 18: 17185

NITROGEN ISOTOPES
exchange between nitric oxide and nitric acid, 18: 16403
properties of hyperfragments of, review, 18: 16963

NITROGEN ISOTOPES N-14
activation of, in mice by protons, 18: 15828
deuteron reactions (d,p) model for, 18: 17053
energy levels, 18: 17060
energy levels of, $(d_{3/2})^2$, 18: 16933 (ANL-6848(p.182-7))
hyperfine coupling constants in chloronitrobenzene, effects of metal ions on, 18: 16068
meson (π^-) absorption by, at rest in emulsion, 18: 16978
proton reactions (p,n), excitation function of total cross section for, 18: 17061
proton scattering at 10.5 Mev, 18: 16951(R) (TID-20311)
reactions with nitrogen-14, neutron reduced widths from, 18: 16929 (ANL-6848(p.160-7))

NITROGEN ISOTOPES N-16
gamma spectra to 8 Mev, 18: 15951(R) (GA-4855)

NITROGEN MUSTARDS
biological effects on brain development in rat embryos, comparison with x rays, 18: 15834
effects on morphology and physiology of rat spleen, 18: 15822

NITROGEN OXIDES
effects of nitric and nitrous, on radiolysis of polyethylene and polypropylene, 18: 16093
electron beam collisions with, emission spectra from, 18: 16700
radiation effects on ESR spectra of di- and tri-, in lead nitrate, 18: 16087
radiosensitivity effects in bacteriophage, x, 18: 15901

NITROGEN SYSTEMS
Ar–N_2, ionization by electron impact, 18: 16720

NOZZLES
flow of two-phase fluid through, 18: 16178(R) (TID-20336)

NUCLEAR EMULSIONS
cosmic particle fragmentation and secondary jets at 1 to 15 Tev in, 18: 16728 (BNL-7534(p.2-28))
fading in neutron, gamma-induced, 18: 16359
meson (π^-) absorption by light nuclei in, 18: 16978
meson (π^-) scattering in, distortion and noise effects on, 18: 16348
neon-20 reactions with bromine and silver in, models for, 18: 17010
particle absorption by nuclei in, hyperfragments from, 18: 16979
particle interactions in, 18: 16732(T) (FTD-TT-64-90(p.163-76))
proton multiple scattering at 27 Bev, 18: 17062
proton ranges in, energy dependence of, 18: 16344
proton reactions at 16 to 2800 Bev, meson (π) production in, 18: 16775
proton scattering in NIKFI-R, coefficients for 9-Bev, 18: 16339
proton stopping in, scattering in, 18: 16552(R) (UCRL-11132)
radiation dosimetry of personnel using, 18: 16357
sensitivity of, for x-ray films, 18: 15938
use in calibration of fission neutron spectrometric system, 18: 16358

NUCLEAR MAGNETIC MOMENTS
relaxation in 3-body systems, 18: 17076

NUCLEAR MAGNETIC RESONANCE
electric field effects on, 18: 17065(T)
electron transfer effects on spectra of, 18: 16027

NUCLEAR MATERIALS MANAGEMENT
bibliography on radiation effects on solid uranium-based nuclear fuel materials, 18: 16529 (VDIT-16(4.1))
comparison of published methods for analysis of irradiated and unirradiated fuel samples, 18: 15960 (SGAE-PH/CH-1/1964)
fissile interactions, eigenvalue matrix treatment of, 18: 16737 (HW-80213)
Plutonium Abstracts, Vol. 4, No. 1, 18: 17353 (HW-68600-35)
specifications for swage-compacted mixed oxide fuel elements for PRTR, 18: 16452 (HW-79290)
spent fuel shipping cask for PM-1 and PM-3A, 18: 16225 (MND-M-1856)

NUCLEAR MODELS
energy levels in, excitation and study of collective, 18: 17020
spectra of nuclei with $A \leq 60$ in, multipole vibrational, 18: 16981

NUCLEAR MODELS (SHELL)
calculations of two-body forces, 18: 17054

NUCLEAR PHYSICS
book: *Constants in Nuclear Physics*, 18: 17255
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in Russian, 18: 17096
book: *The Lightest Atomic Nuclei*, in Russian, 18: 17097
conference, 18: 16561
research progress on, 18: 16552(R) (UCRL-11132)
summary, 18: 17375

NUCLEAR POWER
book: *Summary of Nuclear Energy*, 18: 17375

NUCLEAR POWER PLANTS
design and operation, 18: 17314(P)
economic aspects in electric utility systems, 18: 17305
electrodes for nuclear-thermionic, 18: 16742(R) (GA-4804)

NUCLEAR REACTIONS
analysis of two-nucleon stripping, method for, 18: 16934 (ANL-6848(p.188-98))
analysis of, using multidimensional analyzer, 18: 16321
analysis of, using multidimensional analyzer, 18: 16322
cross section fluctuation in, relation of intensity fluctuations in radio astronomy to, 18: 16637
cross section fluctuation in, direct reaction contribution to, 18: 16938 (ANL-6848(p.228-9))
cross sections for (n,α), statistical-model, 18: 17058
cross sections for, fluctuations in, 18: 17078
cross sections for neutron, 18: 16947 (NP-13661)
cross sections for, 18: 17255
excitation functions and energy spectra of (n,α), statistical analysis of, 18: 17057
model for stripping, 18: 17053
neutron-proton potential in Coulomb stripping, finite-range, 18: 16911 (ANL-6848(p.43-50))
proton, lithium isotopes from fragmentation and spallation, 18: 16977
stripping, polarization of emergent protons from, 18: 16994
studies of, using electromagnetic separation in continential Europe, 18: 16950 (SGAE-PH-2/1964)
theory of, time dependent, 18: 17088
use in neutron measurement, 18: 16356
used in neutron dosimetry, 18: 16355

NUCLEAR SPECTRA
conference on, 18: 16905 (ANL-6848)

NUCLEAR STRUCTURE
excitation of rotational levels by nucleon scattering, 18: 16959
potentials at short ranges, from deuteron elastic scattering, 18: 17041
research program on, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))
theory of intermediate, 18: 16941 (ANL-6848(p.241-8))

NUCLEAR THEORY
collective M1 transitions in, nonexistence of, 18: 17073
energy levels of vibrating particle in $f_{7/2}$ shell, 18: 17075
energy of nuclear matter in ground state, 18: 16960
exchange magnetic moment in three-body nuclei, 18: 17074
nuclear magnetic relaxation of three-spin systems, 18: 17076
perturbation of resonance energy levels in, 18: 16997
potentials in axiomatic quantum field theory, 18: 17050
research program on, AEC, 18: 16413 (TID-4005(Pts.3&4, Rev.2))

NUCLEI
alpha particle elastic scattering by light, cross sections, 18: 17019
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in

Russian, 18: 17096
energy levels of odd-A, f7/2-particle vibrations and, 18: 17075
energy levels of, perturbation of resonance, 18: 16997
energy levels of, excitation and study of collective, 18: 17020
energy levels of, quasi-particle approximation for spurious, 18: 17082
energy of nuclear matter in ground state, 18: 16960
gamma emission from, theory of stimulated, 18: 16952 (TID-20313)
gamma emission, angular correlations in, 18: 16953(R) (TID-20352)
gamma spectra of, intensities of low-energy lines in, 18: 16320
meson (K^-) reactions with complex, 18: 16552(R) (UCRL-11132)
meson (π) elastic scattering by, double charge exchange in, 18: 16939 (ANL-6848(p.236-9))
multiparticle excitations in intermediate compound states of, 18: 17079
neutron reactions with, radiation widths for resonance, 18: 17033
neutron reactions with spin-½, scattering widths for resonance, 18: 17034
neutron reactions (n,α) at 14 Mev, statistical analysis of excitation functions and energy spectra, 18: 17057
neutron reactions (n,α) at 14 Mev, statistical model cross section for, 18: 17058
neutron strength function in nonsymmetric deformed, S-wave, 18: 16956 (ZFK-TPH-7)
nuclear magnetic relaxation of three spin-½, 18: 17076
nucleon scattering by, impulse approximation optical model for, 18: 16953(R) (TID-20352)
nucleon scattering by, nuclear rotational levels from, 18: 16959
particle absorption by, hyperfragments from, 18: 16979
photon reactions (γ,π^0) with complex, theory of, 18: 17063
proton multiple scattering at 27 Bev, 18: 17062
proton reactions at 16 to 2800 Bev, meson (π) production in, 18: 16775
proton scattering by, intermediate resonances in, 18: 16926 (ANL-6848(p.143-6))
quadrupolar deformation of heavy, 18: 16949 (NP-13735)
spectra of, semiclassical description of vibrational, 18: 16981
wave functions for, perturbation calculations of degenerate, 18: 16800

NUCLEI (CELLS)
radiation effects on relation to cytoplasm, review, 18: 15867

NUCLEIC ACIDS
analysis of, automated chromatographic, 18: 15954(R) (LAMS-3034 (p.313-18))
separation of, chromatographic, 18: 15780(R) (LAMS-3034(p.350-72))
synthesis of, in barley seed, 18: 17361(R) (TID-20353)

NUCLEON SHOWERS
production by 82- to 156-Mev protons on nuclei, 18: 16974

NUCLEONS
capture in (d,He^3) reactions on nuclei near A = 40, 18: 16931 (ANL-6848(p.177))
form factors of, isovector, 18: 16781
interactions in nuclei, two-body forces in, 18: 17054
interactions of, characteristics of spin-orbit, 18: 16960
interactions of, research progress on, 18: 16953(R) (TID-20352)
interactions with photons, meson (π) production in, 18: 16798
interactions with protons at 16 to 2800 Bev, meson (π) production in, 18: 16775
interactions with mesons (π^-) at 6.1 to 18.1 Bev/c, strange particle production in, 18: 16776
interactions with mesons (π) at low energies, ($^3/_2$, $^3/_2$) resonances in 18: 16777
interactions with mesons (θ), Lee model for, 18: 16778
interactions with mesons (π) at high energies, Regge pole formalism for, 18: 16779
interactions with mesons (π) at low energies, meson (ρ) effects on, 18: 16781
interactions with mesons (π), 556-Mev p_{33} resonance, 18: 16791
production of N^{*++} in meson (π^-)-proton interactions at 4 Bev/c, cross sections for, 18: 16774
scattering by nuclei, nuclear rotational levels from, 18: 16959

NUCLEOTIDES
nomenclature of oligo-, 18: 15745(R) (LAMS-3034(p.326-8))
synthesis of oligo-, with cytosine and thymine bases, 18: 15779(R) (LAMS-3034(p.329-49))

NUTRIENTS
in survival foods, 18: 16237

O

OAK RIDGE NATIONAL LAB., TENN.
library cataloging rules and practice, manual, 18: 17356 (ORNL-TM-579)

OATS
phototropism in, biochemical effects, 18: 17365(T) (AEC-tr-6362)

OCEANOGRAPHY
of North Sea Area, 18: 17334 (NP-13756(Vol.I))

OHIO
radiation monitoring of air and Great Miami River near Feed Materials Production Center in 1963, 18: 16233(R) (TID-20368)

OILS
analysis for trace metals, activation, 18: 15968

OPTICAL SYSTEMS
development of glass light filter for background reduction in liquid scintillation counting, 18: 16307 (TID-7689(p.31-3))

ORES
analysis for hafnium and thorium, spectral, 18: 15991

ORGANIC COMPOUNDS
analysis for oxygen, manometric, 18: 15963 (UCRL-7618)

ORGANISMS
radioactivity of marine, in sea water, survey, 18: 17335 (NP-13756 (Vol.II))

ORGEL REACTOR
analysis of, statistical hot channel and hot spot, 18: 17296 (EURAEC-910)
coolants for, evaluation of, 18: 17307

ORIFICES
flow of two-phase fluid through, 18: 16178(R) (TID-20336)

OSMIUM
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139

OSMIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)

OTTAWA RIVER
dilution in, tracer study of, using fluorescent dye, 18: 16196
monitoring for radioactivity in, from fallout, 18: 16229 (NP-13760)

OXAZOLES
2,5-diphenyl-, use of, in liquid scintillation, 18: 16375(P)

OXIDES
electric properties of crystals of, emf studies of, 18: 17370(T) (SC-T-64-44)
melting points of 70 metal, compilation, 18: 15996 (NBS-MON-68)

OXYGEN
determination in alkali metal tungsten bronzes and other compounds, 18: 15952 (IS-800)
determination in metals, comparison of neutron-activation and vacuum-fusion, 18: 15951(R) (GA-4855)
determination in organic compounds, manometric, 18: 15963 (UCRL-7618)
determination in potassium, activation, 18: 15951(R) (GA-4855)
effects of high-tension, on radiation effects on dog kidneys, 18: 15880
effects on ionization and power loss in theta-pinch plasma, 18: 17167
effects on operation of potassium–sodium heat transfer system in Dounreay reactor, 18: 17310
effects on radiation effects on p-aminobenzoic acid, 18: 16110
effects on radioinduced oxidation of ferrous sulfate in sulfuric acid, 18: 16095
effects on refractory metal corrosion by alkali metals, 18: 16447
effects on Zircaloy-2 corrosion and hydrogen pickup in steam and water, 18: 16440 (WAPD-283)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ion identification in, at low pressures, 18: 16059
ionization by electron collisions, 18: 16694
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
neutron reactions at 14 Mev, gamma spectra from, 18: 16329
proton energy losses in, 18: 16713
proton reactions at 220 Mev, cross sections for beryllium-10 production in,

18: 17049
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
radiolysis effects on plutonium hexafluoride, 18: 16076 (ANL-6812)
spectra excitation by products from electric discharge in helium, 18: 16719
OXYGEN IONS
distributions in upper atmosphere, 18: 17191
spectral line intensities of lithium-like, 18: 17185
van der Waals radii of, relation of hydration energy to, 18: 16016
OXYGEN ISOTOPES O-14
positron spectra, 18: 16951(R) (TID-20311)
OXYGEN ISOTOPES O-16
activation of, in mice by protons, 18: 15828
electromagnetic monopole transitions in, partial widths for 2γ, 18: 16999
electron inelastic scattering, excited states from, 18: 17027
gamma reactions (γ,n) at threshold to 60 Mev, cross section and resonances in, 18: 16943 (IS-676)
gamma spectra of, transition probabilities for, 18: 16998
helium ^{3} reactions (He^3,α) with, 18: 16907 (ANL-6848(p.8-15))
meson (μ^-) capture rate in, 18: 16552(R) (UCRL-11132)
meson (π^-) absorption by, at rest in emulsion, 18: 16978
nuclear structure of, effects of neutron-proton pairing forces on, 18: 17084
nucleon two-body forces for, shell-model calculations of, 18: 17054
proton reactions (p,t) with, $T = T_z + 2$ states from, 18: 16923 (ANL-6848(p.125-9))
proton reactions (p,α), (p,He^3), and (p,t) on, 18: 16936 (ANL-6848 (p.208-16))
triton reactions (t,n), preparation of fluorine-18 by, 18: 16111
OXYGEN ISOTOPES O-18
decay of 3.63-Mev level of, partial widths for gamma and meson (π)-pair, 18: 17000
helium ion reactions (He^3,n) with, 18: 16935 (ANL-6848(p.199-207))
proton reactions (p,α_0) with, compound-nucleus states from, 18: 17030
OXYGEN SYSTEMS
methane–oxygen, electron scattering by neutral atoms of slightly ionized, cross sections for, 18: 16702

P

PALLADIUM
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
sorptive properties for hydrogen, 18: 17368(T) (AI-Trans-37)
PALLADIUM ALLOYS
Au–Pd, sorptive properties for hydrogen, 18: 17368(T) (AI-Trans-37)
Fe–Pd, magnetic structure at low temperatures, 18: 16894(R) (MIT-3031-1)
Pd–Tc, structure, 18: 16489
Pd–Th, phase studies on, 18: 16501
PALLADIUM DEUTERIDES
spectra, 18: 16575
PALLADIUM HYDRIDES
spectra, 18: 16575
PALLADIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
PALLADIUM ISOTOPES Pd-104
energy levels and gamma spectra of, 18: 16989
PALLADIUM ISOTOPES Pd-111
preparation and properties of, for use as neutron sources, 18: 16379
PAPER
analysis for phosphorus and sulfur, activation, 18: 15970
PARAFFIN
neutron fluxes in, source-containing, 18: 16892 (JUL-140-RX)
paraffin–UF_4, neutron multiplication in, 18: 16891(R) (GA-4881)
PARAMAGNETIC MATERIALS
electron paramagnetic resonance and spin-lattice relaxation in, spectrometer for, 18: 16342
spin-spin relaxation in strong fields, 18: 16046
PARASITES
immunization of mice and monkeys against *Schistosoma japonicum*, by inoculation with irradiated larvae, 18: 15890
PARATHYROID GLANDS
carcinomas of, relation to hyperparathyroidism, 18: 15750
effects of removal of, on creatine excretion in x-irradiated rats, 18: 15876
function of, effects of therapeutic doses of iodine-131 in patients with thyroid diseases on, 18: 15926
PARATHYROID HORMONES
effects of injected, on mineralization of dentin in rat teeth, 18: 15792
PARTICLE STATISTICS
ideal Bose-Einstein, ground state occupancy in confined, 18: 16810
models for heterogeneous materials, 18: 16647 (KAPL-M-CHR-7)
PARTICLE TRACKS
analysis of bubble-chamber, kinematical, 18: 16296 (CERN-64-13(Vol.I) (p.87-129))
automated counting of proton, 18: 16360
coordinate corrections for, in Wilson chambers, 18: 16335
measurement in bubble chambers, equipment for, 18: 16336
measurement in emulsions, distortion and noise effects on, 18: 16348
triplet distribution functions for hard spheres, 18: 16568
PARTICLES
distribution in heterogeneous materials, 18: 16647 (KAPL-M-CHR-7)
pulmonary deposition and retention of inhaled, 18: 15806
residence times in rotary kiln, tracer studies of, 18: 16002 (TID-7689(p.133-6))
PATHOLOGY
conference on immuno-, 18: 15754
radiation, review, 18: 15859
PEACH BOTTOM POWER REACTOR
fuel compact assaying system for, using automatic gamma scanning, 18: 17265
PENNSYLVANIA
population exposure to x rays during diagnostic and dental radiography in Berks County, surveys on, 18: 16248
PENTAERYTHRITOL TETRANITRATE
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026
2,4-PENTANEDIONE
analytical use for spectrometric determination of beryllium, 18: 15967
2-PENTANONE, 4-METHYL-
DBBP–hexone–HCl–8-quinolinol, solvent properties for scandium, 18: 16134
hexone–HCl–8-quinolinol–TOPO, solvent properties for scandium, 18: 16134
PERMEABILITY
measurement of soils radioisotope, device for, 18: 16215
PERSONNEL
conference on radiation dosimetry, Madrid, 1963, 18: 16253
for radiological emergencies, psychological considerations in selection of, 18: 16270
monitoring at Canadian plants by film badges, 18: 16229 (NP-13760)
photographic film detectors of, at CERN synchrotron, nuclear stars in, 18: 16262
radiation doses, method for recording, 18: 16261
radiation dosimetry using nuclear emulsions, 18: 16357
radiation dosimetry, thermoluminescence method for, 18: 16361
radiation dosimetry in Canada, advances in, 18: 16363
radiation dosimetry, review of methods for, 18: 16365
radiation dosimetry, photographic film for, 18: 16256
radiation dosimetry, film holder for use in, 18: 16258
radiation dosimetry, biological methods for, 18: 16259
radiation dosimetry of, relation to biology, 18: 16264
radiation dosimetry in the United States, 18: 16265
radiation dosimetry in the United Kingdom, 18: 16266
radiation dosimetry of Spanish, 18: 16268
uranium mine, measures for protection of, 18: 16240
PERTURBATION THEORY
energy calculations for degenerate many-fermion systems, 18: 16800
energy of nuclear matter in ground state, 18: 16960

for atomic and molecular quantum mechanics, second-order, 18: 16801
PETROLEUM
analysis for trace metals, activation, 18: 15968
cracking plant for, tracer study of catalyst flow distribution in, 18: 16390 (TID-7688(p.84-90))
prospecting of, use of radioactive fluid tracers for, 18: 16192 (TID-7689 (p.38-45))
radiation resistance of mineral oils, effects of liquid scintillator and ultraviolet-light-absorbing compound on, 18: 16127(P)
refining of, tracer studies of leaks in, 18: 16389 (TID-7688(p.80-3))
PHANTOMS
use in dose distribution measurement, accuracy in dogs, 18: 15753
PHARMACEUTICALS
use of activation analysis in, 18: 15977
PHENOL
phenol-*d*–water-d_2, vapor pressure, 18: 16066 (NP-13736)
PHENOTHIAZINE, 2-CHLORO-10-(3-DIMETHYLAMINOPROPYL)–
radiation effects of aqueous solutions of, uv, 18: 16092
PHONONS
density matrix for, approximate method for calculating, 18: 16652(T) (UCRL-Trans-1026(L))
PHOSPHATE IONS
environmental effects on stripping of iron from D2EHPA solutions, 18: 16377(R) (ORNL-TM-515)
PHOSPHATES
sorptive properties with calcite for strontium-90, kinetics of, 18: 17343
PHOSPHINE OXIDE, TRIOCTYL-
hexone–HCl–8-quinolinol–TOPO, solvent properties for scandium, 18: 16134
PHOSPHINE OXIDE, TRIS(1-AZIRIDINYL)–
mutagenic and toxic effects on *Neurospora crassa*, 18: 15868
PHOSPHINE OXIDE, TRIS(1-(2-METHYL)AZIRIDINYL)–
mutagenic and toxic effects on *Neurospora crassa*, 18: 15868
PHOSPHONIC ACID, BUTYL, DIBUTYL ESTER
DBBP–hexone–HCl–8-quinolinol, solvent properties for scandium, 18: 16134
PHOSPHORIC ACID
properties for separation of aluminum from D2EHPA, 18: 16377(R) (ORNL-TM-515)
PHOSPHORIC ACID, ALKYL ESTERS
di-(2-ethylhexyl)ortho-, use for reversed-phase chromatographic separation of alkaline earths and alkali metals, 18: 16141
di(2-ethylhexyl), solvent properties for zirconium-98, 18: 16147
properties of D2EHPA for separation of aluminum from acid solutions at 23 and 65°C, 18: 16377(R) (ORNL-TM-515)
solvent properties for fission product constituents, 18: 16147
PHOSPHORS
luminescence in, review of, 18: 16577
performance of organic, for discriminating between charged particles, 18: 16324
properties of liquid lithium-6 salicylate, 18: 16308 (TID-7689(p.103-5))
radiosensitivity effects of liquid, on mineral oils, 18: 16127(P)
use of manganese-activated calcium fluoride in thermoluminescence dosimetry, 18: 16361
PHOSPHORUS
activation for fast neutron flux measurement, 18: 16356
determination in beer and paper, activation, 18: 15970
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
uptake by banana leaf disks, effects of light on, 18: 15798
PHOSPHORUS(V) CHLORIDES
reactions with irradiated uranium oxides, 18: 16130(T,R) (EURAEC-789)
PHOSPHORUS ISOTOPES P-30
energy levels, 18: 17059
PHOSPHORUS ISOTOPES P-31
energy levels of, parity and spin for, 18: 17080
neutron inelastic scattering by, excited states from, 18: 17025
neutron reactions (n,α) at 14 Mev, 18: 17057
neutron reactions (n,p), cross sections for, 18: 16947 (NP-13661)
proton inelastic scattering by, excited states from, 18: 17071
PHOSPHORUS ISOTOPES P-32
differential uptake of, by tumors of gastrointestinal tract, 18: 15929
incorporation in adenosine 5'-triphosphate, 18: 16085
production of, review of methods for, 18: 16398 (JAERI-4027)
transfer by root systems in hardwood forest, 18: 15757 (TID-7689(p.62-5))
transmutation efficiency in *Saccharomyces cerevisiae*, 18: 15870
PHOTOCHEMISTRY
of plants, biochemical effects of, 18: 17365(T) (AEC-tr-6362)
PHOTOELECTRIC CELLS
performance of germanium for nonsolar sources, 18: 16746
PHOTOGRAPHIC EMULSIONS
use for detecting sub-nuclear particles in the ZGS, 18: 16326
PHOTOGRAPHIC FILM
analysis of bubble-chamber, kinematical, 18: 16296 (CERN-64-13(Vol.I) (p.87-129))
digitizer and data handling system for, flying-spot, 18: 16414 (UCRL-7619)
radiation dosimetry using, 18: 16257
use for personnel dosimetry, 18: 16256
PHOTOGRAPHIC FILM DETECTORS
dosimetry using, United Kingdom progress in, 18: 16360
holder for, for personnel dosimetry, 18: 16258
method for deriving absorbed tissue dose using, 18: 16263
method for personnel dosimetry, 18: 16265
nuclear stars in, 18: 16262
PHOTOMULTIPLIER TUBES
cathodes for, polarization selectivity of cesium oxide, 18: 16346
use in detecting spectral Doppler shifts, 18: 16343
PHOTONS
absorption by helium, ionization in, 18: 16716
absorption by hydrogen, nitrogen, and water vapor at 600 to 1000Å, cross sections for, 18: 16718
absorption by rare gases, cross sections for, 18: 16717
emission in electron reactions with silver foils, 18: 16649 (ORNL-3485)
interactions with nucleons, meson (π) production in, 18: 16798
production by electron reactions with Al and Mg foils, 18: 16670
reactions (γ,π^0) with complex nuclei, theory of, 18: 17063
reactions with carbon ions, 18: 16715
theory as neutrino combination, 18: 16782
PHYSICS
statistics in high-energy, 18: 16408 (CERN-64-13(Vol.I)(p.1-86))
symmetry relation in relaxation dispersions, 18: 16567
PICRIC ACID COMPLEXES
with europium and terbium, luminescence decay of, 18: 16089
PINCH DEVICES
electric current measurements in coils of Cariddi theta-, 18: 17120 (RT/FI(63)-49)
plasma behavior in Bumpy Torus, 18: 17171
plasma properties in theta and Z-, 18: 17159
PINCH EFFECT
dynamics of sinusoidally time-dependent discharge currents, 18: 17160
impurity radiation from theta, effects on ionization rates and power losses, 18: 17167
plasma properties in theta and Z-pinches with trapped reverse magnetic field, 18: 17159
properties of plasma in theta-, during implosion phase in CARIDDI, 18: 17119 (RT/FI(63)-48)
PIPE FITTINGS
design of self-engaging couplings for plugs, 18: 16169(P)
heat transfer in, equations for, 18: 16185
PIPES
heat transfer in, equations for, 18: 16185
heat transfer to, from liquid metals, 18: 16174 (NP-13660)
PITCHBLENDES
age of, direct lead-206/lead-207 ratio determination, 18: 16218
PITUITARY GLAND
radiation effects on function of, in therapy for diabetic retinopathy, alpha and proton, 18: 15927
PLACENTA
zinc-65 transfer across, in rats, effects of dietary levels of copper and molybdenum on, 18: 15794
PLACENTAL TISSUES
radiation effects on rat, effects of, on embryo death, x, 18: 15894
PLANETS

emission of decameter radiation from Jupiter, field-aligned ducts in, 18: 16646
PLANKTON
radioactivity of, from Mediterranean Sea area, 1961 to 1963, 18: 15758(R) (TID-20347)
radioactivity of, from Mediterranean Sea area, 1960 to 1963, 18: 15759(R) (TID-20366)
PLANT CELLS
biochemistry of senescence in, 18: 17361(R) (TID-20353)
radiation effects on, refutation of hit theory for, 18: 15865
PLANTS
carbon dioxide fixation and metabolism by pollen, 18: 15785 (TID-7689 (p.68-9))
d-tryptophan derivation from higher, 18: 17366(T) (AEC-tr-6363)
effects of deuterium oxide on growth of mint, 18: 15861
radiation dosimetry of, method for, 18: 16267
strontium-90 content of, in German Democratic Republic, 1962, 18: 15909
PLASMA
absorption coefficient and microwave conductivity of slightly ionized, 18: 17218
acceleration by electromagnetic and magnetostatic field gradients, 18: 17151
accelerator for, design of electromagnetic, 18: 17241(P)
analysis of uniform, application of operational methods in, 18: 17146
behavior in Bumpy Torus, 18: 17171
book: *An Introduction to Plasma Physics*, 18: 17192
book: *Fundamentals of Cosmic Electrodynamics*, 18: 17122(T) (NASA-TT-F-175)
book: *Problems in Plasma Theory*, 18: 17189
boundary layer shape with magnetic field, self-consistent calculational method for, 18: 17165
collision processes in helium, at 4.2°K, 18: 17193
composition of single-element, method of calculating, 18: 17212
conductor of, convective flexure of, 18: 17181
conference on ionization phenomena in gases, Paris, July 8-13, 1963, Vol. I, 18: 16689
conference on, IEEE-PTGNS meeting in San Diego, Oct. 1963, 18: 17126
cyclotron instability in homogeneous, with anisotropic non-Maxwellian ion distribution, 18: 17155
decay in magnetic field, 18: 17227
decay in metals, photon emission in, 18: 16670
diagnostics of high-temperature, 18: 17103 (ARL-64-6)
diagnostics of shock-arc-heated monatomic, using interferometric analysis, 18: 17175
diagnostics of upper-atmosphere, using satellite-borne probes, 18: 17191
diagnostics of, dynamic properties of Langmuir probes for, 18: 17182
diagnostics of, dynamic properties of Langmuir probes for, 18: 17183
diagnostics of, from effects on transfer functions of communication systems, 18: 17144
diagnostics of, instruments for, 18: 17114 (NP-13705)
diagnostics of, spectroscopic technique for electron temperature and percentage ionization in, 18: 17177
diagnostics of, using atomic beam probes, 18: 17121(R) (TID-20362)
dielectric constant of fully ionized, 18: 17202
dielectric constant of argon afterglow, 18: 17234
diffusion across magnetic field, Boltzmann moment equations for, 18: 17226
electric conductivity between electrodes in argon, 18: 17222
electric conductivity of, comparison of calculations and measurements, 18: 17224
electric field strength in, Stark effect for measuring h-f, 18: 17188
electric probes in, cation collection by, 18: 17186
electrodynamics in space, fundamentals and relation to astrophysics and geophysics, 18: 17122(T) (NASA-TT-F-175)
electromagnetic wave absorption in cylindrical, 18: 17153
electromagnetic wave propagation through diffusing, in slab geometry, 18: 17129
electromagnetic wave propagation in circular column of, with impedance boundary conditions, 18: 17130
electromagnetic waves in, excitation by charged particle motion, 18: 17190
electron and ion collisional-radiative recombination in hydrogen, 18: 17184
electron and ion mobilities in weakly ionized, 18: 17219
electron and ion temperature relaxation in, in strong magnetic field, 18: 17217
electron distribution function relaxation rate in, 18: 17233
electron temperature in, spectroscopic determination of, 18: 17185
energy and movement exchange between electrons and ions in flowing, 18: 17210
energy of, correlation between kinetic and potential, 18: 16662
energy transfer mechanisms in flame, 18: 17213
equilibrium properties of high-temperature, continuum description of, 18: 17204
flow in low-density hypersonic wind tunnels, gasdynamics of, 18: 17136
flow of, gasdynamic instrumentation of high-enthalpy, 18: 17145
flow through transverse magnetic field, deceleration and polarization in, 18: 17174
heat transfer from, shock tube study of radiative, 18: 17173
hydrogen beam reactions with magnetically confined, cascade excitation processes in, 18: 17194
impurity effects on electron temperature and radiation intensities for theta-pinched, 18: 17179
injection and trapping in magnetic fields, 18: 17128
injection into GVL-2 device, 18: 17108 (NP-13609)
injection into magnetic trap, 18: 17110 (NP-13623)
interactions in transverse magnetic fields, 18: 17115 (NP-13706)
interactions with dipole magnetic field, cavity from, 18: 17149
ion density in barium, method of measurement of, 18: 17168
ion energy losses in Maxwellian, 18: 17211
ion extraction from, plasma boundary position in, 18: 17240
ionization energy lowering for, with different temperatures of particle components, 18: 17208
ionization equilibrium of, effects of fields around charged particles on, 18: 17205
ionization potential reduction and partition function in, divergence problem of, 18: 17206
kinetic theory for multicomponent, Bogoliubov, 18: 17102 (AD-431025)
kinetic theory of spatially homogeneous, superposition of dressed test particles in, 18: 17163
kinetic theory of, test-particle method in, 18: 17164
kinetics of spatially homogeneous, equations for, 18: 17196
kinetics of, exchange and quantum corrections to theory of, 18: 17195
kinetics of, in magnetic field, equations for, 18: 17199
magnetic field distribution and Fokker-Planck coefficients in, 18: 17104 (ARL-250(Pt.II))
magnetogasdynamic flow with heat transfer, one-dimensional, 18: 17172
microwave diagnostics of, plane-wave attenuation and phaseshift from electron density and collision characteristics in, 18: 17143
microwave radiation from d-c discharge in a magnetic field, harmonic structure of, 18: 17147
microwave radiation from d-c discharge in magnetic field, harmonics in, 18: 17148
motion in toroidal magnetic field, 18: 17113(NP-13698)
motion of striations in high-current d-c discharge, 18: 17124
oscillations in bounded nonuniform, with density gradients perpendicular to lines of force of magnetic field, 18: 17180
oscillations in, electron-beam excitation of, 18: 17112 (NP-13697)
oscillations in, effects of electron–electron and electron-ion correlations in, 18: 17201
oscillations in, spectra of high-frequency, 18: 17109 (NP-13612)
oscillations of cylindrical, in magnetic field, resonance excitation and Cherenkov damping of h-f, 18: 17154
oscillations of, effects of collisions on, 18: 17166
oscillations with collective correlations in unbounded, rarefied, 18: 17200
pair distribution functions for, outside equilibrium, 18: 17198
particle and wave interactions in, theory of, 18: 17157
particle losses of cesium, in stellarator, 18: 17228
partition function for fully ionized, 18: 17207
physics of, research progress on, 18: 16552(R) (UCRL-11132)
pinch dynamics in, for sinusoidally time-dependent discharge currents, 18: 17160
pinch effect in, impurity radiation losses from theta, 18: 17167

pinch effect in, theta and Z-, 18: 17159
positive column of mercury arc discharge, effects of axial magnetic field on, 18: 17142
positive ion movement through space charge sheath for cylindrical, plane, or spherical, 18: 17221
production and properties of, research progress on, 18: 17117(R) (NP-13743)
production by injection, excited neutral atom production for, 18: 17118 (NP-13744)
production by magnetic pumping in stellarator, 18: 17156
production by reflection of electromagnetically driven shocks, 18: 17137
production by wall-constricted d-c arc, physics of, 18: 17133
production in rail-type gun, 18: 17131
production in two-stage repetitively fired coaxial gun, characteristics of, 18: 17140
production of cesium, 18: 17127
production of high-temperature deuterium or tritium, device for, 18: 17242(P)
properties of electronegative-gas-seeded supersonic streams of, 18: 17176
properties of theta-pinch, during implosion phase, 18: 17119 (RT/F1(63)-48)
quantum mechanics treatment of correlations in electron, 18: 17197
radiation emission from arc-heated nitrogen, spectroscopy of continuum, 18: 17135
radiation losses by cesium-seeded argon, 18: 17105 (BSD-TDR-64-6)
relaxations in, unified theory of, 18: 17106 (IPPJ-17)
sheath simulation by plane of wires, 18: 17139
source development, 18: 17121(R) (TID-20362)
space charge properties of r-f, 18: 17238
spectra of thermal, effects of metastable atoms on emission, 18: 17215
spectra of, detection of Doppler shift in, 18: 16343
stability conditions for bounded, micro-, 18: 17162
stability in helical magnetic field, flute perturbations of, 18: 17158
stability in low-pressure, resistive, 18: 17230
stability of electron oscillations in nonuniform, effects of external magnetic field on macroscopic, 18: 16773
stability of, Compton effect on, 18: 17203
stability of, energy principle for electrostatic, 18: 17161
temperature equalization rates for electrons and ions in, along and transverse to magnetic field, 18: 17152
temperature measurement in, use of Doppler effect for, 18: 17170
thermal stability of cylindrical column, 18: 17229
thermodynamic equilibrium in, formulation for departures from, 18: 17209
transport properties of fully ionized, low-temperature alkali metal, 18: 17223
wave motion in, nonlinear Vlasov equation for, 18: 16819
wave propagation in spoke-wheel magnetic field in cold, 18: 17150
wave propagation in cold, in magnetic field, whistler-mode, 18: 17187

PLASMA JETS
detection and measurement of neutral component of, by resonance radiation absorption, 18: 16581
performance of modified Penning-arc, propulsion application of, 18: 17123
production by arc-heated tube, energy transport and gas flow processes in, 18: 17132
radiation probe for arcjet measurements, 18: 17138

PLASTICS
decontamination by ultrasonics, 18: 16250
luminescence of, discrimination of alpha-, deuteron-, and proton-produced, 18: 16324
use for scintillographs, 18: 16366

PLATES
blast loading of rectangular, calculation of inertial load in, 18: 17359 (SCL-TM-64-34)
energy transfer between, by two-temperature gas, 18: 16549 (ATN-64 (9232)-1)

PLATINUM
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
catalytic deuteration of alkyl benzenes on, mechanisms of π-complexes in, 18: 16040
effects on corrosion of molybdenum–uranium alloy at 650°F, 18: 16449(P)
exchange reactions between deuterium and methane on, catalytic, 18: 16034
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (Al-Trans-38)
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139

PLATINUM ALLOYS
Pt–Ru, catalytic exchange reactions between deuterium and methane on, 18: 16034
Pt–Tc, structure, 18: 16489

PLATINUM ELECTRODES
electroplating zinc-65 on, procedure for, 18: 16104

PLATINUM ISOTOPES
neutron reactions with, scattering widths for resonance, 18: 17034
spectra of, shifts in x-ray, 18: 17064(T)

PLATINUM ISOTOPES Pt-195
neutron reactions with, radiation widths for resonance, 18: 17033
neutron reactions with, radiation widths for resonance, 18: 17036

PLATINUM ISOTOPES Pt-198
neutron reactions with, radiation widths for resonance, 18: 17033

PLEURISY
radiation effects on, in guinea pigs, 18: 15877

PLOWSHARE PROJECT
applications of nuclear excavations, 18: 16162 (UCRL-7657)

PLUTONIUM
bibliography on, 18: 17353 (HW-68600-35)
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
grain structure in alpha, x-ray micrography of, 18: 16482 (UCRL-7651)
hyperfine structure of, 18: 17083
properties of, electric, magnetic, mechanical, and thermal, 18: 16493
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from irradiated fuel elements by solvent extraction, radiation effects on, 18: 16143
solubility in calcium–zinc alloys, 18: 16153

PLUTONIUM ALLOYS
Al–Pu, phase diagrams of, 18: 16493
Al–Pu, processing of irradiated, TBP process for, 18: 16152
Be–Pu, phase diagram of, 18: 16493
Fe–Pu, phase diagrams of, 18: 16493
Li–Pu, phase diagram of, 18: 16493
Mo–Pu, phase diagram of, 18: 16493
Mo–Pu–U, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, fabrication and properties for use as fuel element in Rapsodie, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, radiation stability, 18: 17290(T) (AEC-tr-6359)
Pu–U, phase diagrams of, 18: 16493
Pu–Zr, phase diagrams of, 18: 16493

PLUTONIUM CARBIDES
PuC–UC, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
PuC–UC, compatibility with niobium, niobium–zirconium alloy, type 316 stainless steel, and Zircaloy-2 at 1100 and 1500°F, 18: 16426(R) (UNC-5068)
PuC–UC, crystal structure and phase studies, effects of aging on, 18: 16426(R) (UNC-5068)
PuC–UC, preparation, 18: 16049
PuC–UC, preparation and properties as reactor fuel material, 18: 16426(R) (UNC-5068)
PuC–UC, properties for use as reactor fuel in Rapsodie, 18: 17290(T) (AEC-tr-6359)
PuC–UC, radiation effects on crystal structure of, 18: 17351(R) (BMI-1659(Del.))
PuC–UC, radiation stability, 18: 17290(T) (AEC-tr-6359)

PLUTONIUM COMPOUNDS
properties of, review of, 18: 16051

PLUTONIUM FLUORIDES
preparation and properties, 18: 16153
radiolysis of, effects of fluorine, helium, krypton, and oxygen on, 18: 16076 (ANL-6812)
PLUTONIUM IONS
hydrolysis and polymerization of tetravalent, in solvent-extraction processes, 18: 16152
PLUTONIUM ISOTOPES Pu-238
recoil thrust on flat-plate alpha sources of, 18: 17324
PLUTONIUM ISOTOPES Pu-239
neutron fission of, cross sections at 0.06 to 0.3 ev, 18: 17002
nuclear magnetic moment of, 18: 17083
pathological effects of, injected in dogs, 18: 15817(T) (FTD-TT-63-559 (p.150-72))
toxic effects of, in mammals, 18: 15786(T) (FTD-TT-63-559)
PLUTONIUM ISOTOPES Pu-240
reactivity of, in homogeneous uranium trioxide-water mixtures, 18: 16736 (HW-79413)
PLUTONIUM ISOTOPES Pu-241
neutron cross sections for, Doppler broadening of, 18: 16942 (IDO-16954)
PLUTONIUM NITRIDES
corrosion by liquid lithium and liquid sodium, 18: 17351(R) (BMI-1659(Del.))
properties, 18: 16473 (HW-SA-3370)
thermal stability, 18: 16473 (HW-SA-3370)
PuN–UN, thermal stability, 18: 16473 (HW-SA-3370)
Pu–UN, lattice parameters of solid solutions of, 18: 16473 (HW-SA-3370)
PLUTONIUM OXIDES
fluorination of irradiated, 18: 16130(T,R) (EURAEC-789)
PLUTONIUM(IV) OXIDES
PuO_2–UMO, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, fluorination and oxidation, 18: 16130(T,R) (EURAEC-789)
PuO_2–UO_2, properties for use as fuel element in Rapsodie, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, radiation stability, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, synthesis of carbon-stabilized, 18: 16426(R) (UNC-5068)
PLUTONIUM RECYCLE CRITICAL FACILITY
criticality and neutron physics experiments in, program of, 18: 17298 (HW-80092)
PLUTONIUM RECYCLE TEST REACTOR
fuel element fabrication for Mark I-M specifications for, 18: 16452 (HW-79290)
fuel element fabrication for Mark I-L, specifications for vibrationally compacted mixed-oxide, 18: 16453 (HW-79291)
PLUTONIUM SYSTEMS
As–Pu, preparation, 18: 17351(R) (BMI-1659(Del.))
Pu–Si, phase studies, 18: 17351(R) (BMI-1659(Del.))
POLLEN
carbon dioxide fixation and metabolism by, tracer studies of, 18: 15785 (TID-7689(p.68-9))
POLONIUM
process wastes decontamination of, 18: 16376(R) (MLM-1157)
review, 18: 15946(T) (MLM-1165(Tr))
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
POLONIUM ISOTOPES Po-208
alpha/gamma counting ratio measurements for, 18: 16376(R) (MLM-1157)
half life, 18: 16376(R) (MLM-1157)
POLONIUM ISOTOPES Po-209
alpha-activity and mass measurements for, 18: 16376(R) (MLM-1157)
half life, 18: 16376(R) (MLM-1157)
POLONIUM ISOTOPES Po-210
recoil thrust on flat-plate alpha sources of, 18: 17324
POLYMERS
properties of, relation to structure, 18: 17371(T) (SC-T-64-45)
radiation effects on, molecular distribution in, 18: 16123
POLYSACCHARIDES
sulfur determination in algal, neutron activation method for, 18: 15965
POPULATIONS
cesium-137 and potassium-40 body burdens in Nashville, Tennessee, factors influencing, 18: 16232 (TID-18603)
distribution of animal, off Cape Cod, 18: 17363 (TID-20363)
radiation exposure of mice, for 15 generations, effects on breeding characteristics of, 18: 15809(R) (LAMS-3034(p.124-8))
radiation exposure of, from diagnostic and dental radiography, survey on, 18: 16248
POROUS MATERIALS
percolation rates in, equations for, 18: 16010
POSITRONS
annihilation in alkali halides, 18: 16665
annihilation in condensed media, angular distribution of radiation from, 18: 16304 (NP-13693)
collisions with hydrogen ions, electron detachment in, 18: 16683
polarization in sodium-22 decay, 18: 16552(R) (UCRL-11132)
storage ring for 450-Mev, design of, 18: 16609 (LAL-1081)
POTASSIUM
analysis for oxygen, activation, 18: 15951(R) (GA-4855)
determination in biological samples, soils, and waters, flame spectrophotometric, 18: 15957 (RT/PROT(63)-13)
effects on cesium sorption by clay minerals, 18: 17344
effects on nitrogen-14 hyperfine coupling constants in EPR spectra of chloronitrobenzene, 18: 16068
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
heat transfer by, 18: 17322(R) (TID-19971)
ionization of, Auger effect in, 18: 16698
ionization of, fractional, 18: 17121(R) (TID-20362)
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
radiation effects on content of, in rat serum and urine, x, 18: 15842
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
uptake by banana leaf disks, effects of light on, 18: 15798
uptake by eye lenses with radioinduced cataracts, 18: 15816(T) (CEA-tr-R-1635)
vapor pressure of, correspondence with cesium, mercury, rubidium, and sodium, 18: 16035
POTASSIUM ALLOYS
K–Na, effects of impurities on operation of heat transfer system of, 18: 17310
K–Na, heat transfer to copper pipes, 18: 16173 (NP-13656)
POTASSIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KBr–NaBr, solvent properties for niobium, 18: 16032
POTASSIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
radiolysis of, mechanism of gamma, 18: 16119
thermoelectron emission and thermoluminescence of doped, 18: 16083
KCl–NaCl, solvent properties for niobium, 18: 16032
LiCl–KCl, solvent properties for niobium, 18: 16032
POTASSIUM CHROMATES
radiation effects on, effects of radiation, thermal, and uv annealing on neutron, 18: 16114
Szilard-Chalmers reactions in, effects of thermal and uv annealing on, 18: 16115
POTASSIUM FERROCYANIDES
electrochemical oxidation by rotating disk electrode, 18: 16004 (TID-20339)
POTASSIUM FLUONIOBATES
NaCl–K_2NbF_7–ZrF_4, production of niobium–zirconium alloys by electrolysis of, 18: 16431
POTASSIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KF–NaF–ZrF_4, phase diagram of, liquidus surface in, 18: 16008(T) (ORNL-tr-31)
POTASSIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
radiolysis of, mechanism of gamma, 18: 16119
POTASSIUM IONS

van der Waals radii of, relation of hydration energy to, 18: 16016
POTASSIUM ISOTOPES K-39
proton inelastic scattering by, excited states from, 18: 17071
POTASSIUM ISOTOPES K-40
body burden in Nashville, Tennessee, factors influencing, 18: 16232 (TID-18603)
contribution of, to cesium-137 photopeak in gamma spectrometer with sodium iodide crystal, 18: 16302(R) (LAMS-3034(p.162-7))
determination in bone samples, radiometric, sample preparation for, 18: 15953(R) (LAMS-3034(p.201-4))
determination in beagle hounds, 18: 15771(R) (LAMS-3034(p.73-5))
determination in man, whole-body, 18: 16300(R) (LAMS-3034(p.143-51))
production in iron by 730 Mev, protons, cross sections for, 18: 17049
POTASSIUM ISOTOPES K-41
energy levels, 18: 16945 (NP-13601)
POTASSIUM ISOTOPES K-42
energy levels of, $(t_{r/2})$, 18: 16933 (ANL-6848(p.182-7))
POTASSIUM PERTECHNETATES
corrosion-inhibiting properties, 18: 16443(T) (ORNL-tr-32)
POTASSIUM SODIUM TARTRATES
radiation effects on dielectric properties, 18: 16545
POWER REACTORS
design of thermionic, 18: 17315(P)
dynamic behavior of Danish GAMMA II, 18: 17301 (NP-13499)
economic evaluation of, long-term, 18: 17306
fission rate measurement in, by activation, 18: 17278 (KAPL-M-6101)
PRASEODYMIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from aqueous electrolytes by lithium amalgam electrolysis, 18: 15945 (LADC-6084)
PRASEODYMIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505
PRASEODYMIUM ISOTOPES Pr-141
neutron reactions with, resonances in, 18: 17035
PRASEODYMIUM ISOTOPES Pr-144
energy levels of, spin-parity of ground-state, 18: 17013
separation from fission products by amalgam exchange, radiochemical, 18: 16148
PRECIPITATION
monitoring by radar, fallout prediction from, 18: 16202(R) (AD-416645)
PREGNANCY
radiation effects on rat, x, 18: 15894
PRESSURE DROP
in steam–water mixtures flowing in vertical tubes, 18: 16172 (EURAEC-951)
in two-phase flow of air–water mixtures on four-rod assembly, effects of twist strips on, 18: 16182(T) (EURAEC-638)
PRESSURE GAGES
design of alpha-particle, 18: 16383 (TID-7688(p.7-13))
effects of cesium vapor on, at 10^{-4} torr, 18: 16277 (NASA-TN-D-2264)
PRESSURE VESSELS
cleaning of interior, controlled humidity technique for, 18: 17264
containment shells, internal blast effects on models of, 18: 17258 (BRL-Memo-1530)
design analysis of prestressed two-layer, with expanded inner layer, 18: 17260 (ORNL-3546(Suppl.1))
design for liquid-moderated pressure-tube reactor with bell-shaped liquid-level equalizer, 18: 17268(P)
design relations for toroidal, 18: 16164 (ERR-AN-174)
structural problems in reactor, 18: 17262
welding by submerged-arc techniques, 18: 16459(T,R) (EURAEC-962)
PRESSURIZED WATER REACTORS
cooling system design for heavy water–light water mixtures, 18: 17269(P)
cooling system pump breakdown in, 18: 17267
PROMETHIUM
separation from gadolinium by lithium amalgam electrolysis, 18: 15945 (LADC-6084)
PROMETHIUM ISOTOPES Pm-151
beta decay of, internal conversion spectra from, 18: 17017
decay of, electron spectra from, 18: 16325
PROPANE
CF_3Br–propane, meson (π^-) absorption in, cross section for, 18: 16776
PROPENE POLYMERS
diffusion of radon and tritium through films of, 18: 16550 (TID-7688 (p.64-7))
radiation effects on, ESR spectra of, 18: 16097
radiolysis in presence of nitric and nitrous oxides, yields in, 18: 16093
PROPORTIONAL DETECTORS
efficiency of boron fluoride filled, 18: 16891(R) (GA-4881)
performance for neutron dose rates, 18: 16299 (LAMS-2977)
pulse amplitude converters for, 18: 16341
use in x-ray emission analyzers, 18: 16292(P)
PROPULSION
ion beam extraction from plasma source for, 18: 17240
ion thrustor use in satellite control systems, 18: 16582
ion, characteristics of surface-contact Hall-current accelerator for, 18: 16559
ion, performance of two-stage repetitively fired coaxial plasma gun for, 18: 17140
plasma jet, performance of modified Penning arc for, 18: 17123
PROSPECTING
radiometric methods of, for radioactive minerals, effects of fallout on, 18: 16220
PROTACTINIUM ISOTOPES Pa-231
alpha decay scheme of, 18: 16985
PROTACTINIUM ISOTOPES Pa-234
energy level structure of, unified model for, 18: 16987
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
PROTECTIVE CLOTHING
design of suit of impermeable material, 18: 16272(P)
PROTEINS
labeling with iodine-125 for immunologic tracer studies, 18: 15916 (TID-7689(p.17-20))
radiation effects on guinea pig liver, x, 18: 15813 (NP-13733)
synthesis and chemical structure of, 18: 15805
PROTON BEAMS
effects on quartz crystal thermoluminescence, 18: 16120
energy of cyclotron, system for measuring, 18: 16611 (ZFK-PHA-5)
interactions of colliding, problems in experimentation on, 18: 16592 (BNL-7534(p.277-307))
interactions of colliding, possible boson (W) production in annihilation, 18: 16752 (BNL-7534(p.308-11))
interactions of crossed, storage ring design and performance for, 18: 16585 (BNL-7534(p.128-70))
scattering in nuclear emulsions at 9 Bev, coefficients for, 18: 16339
storage rings for, for CERN PS, 18: 16585 (BNL-7534(p.128-70))
PROTON PAIRS
annihilation in deuterium, 18: 16652(R) (UCRL-11132)
PROTON SOURCES
use in radiobiology, 18: 15866
PROTONS
acceleration in 12-Mev tandem Van de Graaff accelerator, 18: 16616
activation of carbon-12, nitrogen-14, and oxygen-16 in mice by, 18: 15828
angular distribution in carbon-12 (He^3,p) reactions at 1.8 to 5.4 Mev, 18: 17060
angular distributions from alpha bombardments of nuclei, 18: 16951(R) (TID-20311)
biological effects in mammals, 18: 15826
collisions with atomic hydrogen at low energies with $2p\sigma$-$2p\pi$ coupling, 18: 16684
detection and discrimination using organic phosphors, 18: 16324
diabetic retinopathy by hypophysectomy using, 18: 15927
effects on mouse skin, 18: 15827
effects on rats, age effects on, 18: 15815 (USNRDL-TR-712)
emission in deuteron reactions (d,p) with aluminum-27 at 6.6 Mev, angular distributions for, 18: 17091
emission in deuteron reactions (d,p) with chromium isotopes at 6.6 Mev, angular distributions for, 18: 17092
emission in deuteron reactions (d,p) with iron isotopes at 6.6 Mev, angular distributions for, 18: 17093
energy losses in passage through target gases, 18: 16713
interaction with antiprotons and protons, forward scattering amplitude in,

18: 16787
interactions at 138 Mev, polarization effects on, 18: 16772
interactions in Bev range, hydrocarbon films for analyzing elastic, 18: 16794
interactions with protons, colliding-beam study of, 18: 16591 (BNL-7534(p.253-76))
interactions with protons at high momentum transfer, problems in colliding-beam techniques for, 18: 16592 (BNL-7534(p.277-307))
interactions with neutrons, reactor-synchrotron system for studying, 18: 16600 (BNL-7534(p.406-13))
interactions with cosmic protons at 300 Bev, diffraction peak width parameter for elastic, 18: 16729 (BNL-7534(p.29-38))
interactions with elementary particles, feasibility of using 600- to 1000-Bev accelerators to study, 18: 16749 (BNL-7534(p.83-7))
interactions with neutrinos and antineutrinos, use of 1000-Bev accelerator to study, 18: 16750 (BNL-7534(p.88-106))
interactions with protons, colliding-beam technique for elastic, 18: 16751 (BNL-7534(p.238-52))
interactions with antiprotons, colliding-beam technique for possible boson (W) production in, 18: 16752 (BNL-7534(p.308-11))
interactions with antineutrino, cross sections for absorption, 18: 16760 (LAMS-3013)
interactions with neutrons at low temperatures, total cross sections for, 18: 17081
interactions with nucleons, semi-phenomenological analysis of, 18: 16953(R) (TID-20352)
interactions with mesons (K) and (π), 18: 16552(R) (UCRL-11132)
interactions with protons, 18: 16552(R) (UCRL-11132)
interactions with mesons (π^-) at 4 Bev/c, resonance production in, 18: 16774
interactions with nucleons at 16 to 2800 Bev, meson (π) production in, 18: 16775
interactions with protons, statistical model of elastic, 18: 16788
interactions with protons at 8.5, 12.4, and 18.4 Bev/c, elastic, 18: 16789
interactions with mesons ($\pi^{\pm}$) at 8.5, 12.4, and 18.4 Bev/c, elastic, 18: 16789
interactions with mesons (π^+) at 3.65 Bev/c, 18: 16790
interactions with mesons (π^-), spin of f^0 resonances in, 18: 16792
mobility of, relation to electron exchange in aqueous iron solutions, 18: 16019
properties of, book on, 18: 17097
ranges in emulsions, energy dependence of, 18: 16344
reactions (p,α_0) with oxygen-18, compound-nucleus states from, 18: 17030
reactions (p,α), fluctuations in cross sections for, 18: 17078
reactions (p,α) of, cross section fluctuations in, 18: 16938 (ANL-6848(p.228-9))
reactions (p,γ) with silicon-30 at 1.00 to 1.53 Mev, angular correlations for, 18: 17080
reactions (p,γ) at 1.4 Mev, gamma rays from, 18: 17059
reactions (p,γ) with aluminum, beryllium, bismuth, carbon, cobalt, and water at 160 Mev, gamma spectra from, 18: 16315
reactions (p,d) with boron and calcium isotopes, mechanisms for, 18: 17043
reactions (p,d) with carbon-13 and -14, 18: 16914 (ANL-6848(p.70-8))
reactions (p,d) with carbon-13, singlet di-nucleon state in, 18: 16932 (ANL-6848(p.180-1))
reactions (p,n) with vanadium-51, excitation functions for, 18: 16996
reactions (p,n) with nitrogen-14, excitation functions for, 18: 17061
reactions (p,t) of, $T = T_z + 2$ states from, 18: 16923 (ANL-6848 (p.125-9))
reactions (p,t), (p,He^6), and (p,α) on oxygen-16, 18: 16936 (ANL-6848(p.208-16))
reactions (p,2p) with carbon-12, cross sections near 100 Mev, 18: 17045
reactions (p,$^3He^4He$) with lithium-6, cross sections for, 18: 17029
reactions (p,9n or 10n) with terbium-159, excitation functions, 18: 16975
reactions in iron, spallation cross sections for, 18: 17049
reactions on nuclei at 82 to 156 Mev, nucleon cascades from, 18: 16974
reactions with bismuth, gold, and uranium at 156 Mev, fission, 18: 17004
reactions with copper at 100 to 500 kev, x rays from, 18: 16663
reactions with emulsion nuclei, hyperfragments from, 18: 16979
reactions with emulsion nuclei at 16 to 2800 Bev, meson (π) production in, 18: 16775
reactions with hydrogen atoms, electron capture cross section for, 18: 16675
reactions with light nuclei, WKB distorted-wave approximation for, 18: 16906 (ANL-6848(p.2-7))
reactions with nuclei, lithium-6 and -7 fragments from, 18: 16977
reactions with stellar iron ions, excitation of spectral lines in, 18: 16635
reactions with thorium-232, actinium isotopes from, 18: 16976
reactions with tritium at 1.9 to 3.5 Mev, neutron polarization in, 18: 17052
scattering by carbon-12, polarization effects in inelastic, 18: 17044
scattering by emulsion nuclei at 27 Bev, multiple, 18: 17062
scattering by heavy nuclei at 17 Mev, 18: 16920 (ANL-6848(p.114-17))
scattering by holmium-165, coupled-channel analysis of, 18: 16940 (ANL-6848(p.24-9))
scattering by nitrogen-14 at 10.5 Mev, 18: 16951(R) (TID-20311)
scattering by nuclei at 155 Mev, excited states from, 18: 17042
scattering by nuclei at 155 Mev, excited states from inelastic, 18: 17070
scattering by nuclei at 155 Mev, excited states from inelastic, 18: 17071
scattering by nuclei, intermediate resonances in, 18: 16926 (ANL-6848(p.143-6))
scattering by titanium-48, selection rules in inelastic, 18: 16930 (ANL-6848(p.168-71))
scattering of 40-Mev, analysis of, 18: 16924 (ANL-6848(p.130-6))

PROTOZOA
strontium content of Acantharia, 18: 15758(R) (TID-20347)
strontium content of Acantharia, 18: 15759(R) (TID-20366)

PSYCHOLOGY
use in selection and training of emergency personnel, 18: 16270

PULMONARY ABSORPTION
of inhaled aerosols and particles, 18: 15806

PULMONARY EXCRETION
of inhaled aerosols and particles, 18: 15806

PULSE ANALYZERS
design and performance of tunnel diode discriminator for space craft, 18: 16284
design for fission fragment mass distribution measurements, 18: 16338
design of transistorized, for G-M tubes, 18: 16345
memory devices for, 18: 16340

PULSE MODIFIERS
design of amplitude converters for proportional counters, 18: 16341

PUMPS
breakdown of coolant-circulating, in pressurized-water reactors, 18: 17267

PUMPS (LIQUID METAL)
testing of sodium, facility for, 18: 16166 (WCAP-2526)

PUREX PROCESS
waste treatment methods evaluation, 18: 16377(R) (ORNL-TM-515)
wastes from, processing of, 18: 17332(R) (HW-80526)

Q

QUALITY CONTROL
process start and control procedures, 18: 17357 (SC-DC-64-378)

QUANTUM MECHANICS
continuum description of high-temperature plasma, 18: 17204
equilibrium properties of particles with radial interaction potential, 18: 16809
Fokker-Planck equations for Brownian motion of self-interacting electron gas, 18: 16818
group representations in, methods for reduction of, 18: 16806
magnitude of NMR spectrum splitting in electric field, 18: 17065(T)
partition function for fully ionized gas, 18: 17207
perturbation theory in atomic and molecular, second-order, 18: 16801
plasma correlations treatment in, 18: 17197
reciprocity in, 18: 16802
relativistic scattering theory, 18: 16769
spin systems in, relaxation of isolated, 18: 16046
superkinetic equations for spatially homogeneous plasmas, 18: 17196
Vlasov equation moments, 18: 16819

wave function with pairing correlations for finite systems, 18: 17084
wave propagation in random medium, 18: 16807
weak coupling theory in, kinetic equations and multi-time-scale formalism in, 18: 16817

QUARTZ
electric properties, 18: 17370(T) (SC-T-64-44)
magnetic field effects on etching of, 18: 16535
neutron spin-orbit scattering by monocrystalline, polarized, 18: 16894(R) (MIT-3031-1)
radiation effects on thermoluminescence of, 18: 16120
radiation effects on thermoluminescence of germanium-doped and natural, 18: 16121
radiation effects on etching of, 18: 16535

8-QUINOLINOL
DBBP–hexone–HCl–8-quinolinol, solvent properties for scandium, 18: 16134
hexone–HCl–8-quinolinol–TOPO, solvent properties for scandium, 18: 16134

QUINONES
isopropyl-, effects of electron transfer on high-resolution NMR spectra of, 18: 16027
2,5-diethoxy-, effects of electron transfer on high-resolution NMR spectra of, 18: 16027

R

RABBITS
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
iodine-131 effects on Freedman reaction in, 18: 15821
radiation effects on glycogen content of eye in, x, 18: 15837(T)
radiation effects on immune reactions in, 18: 15857
radiation effects on blood serum and enzymatic system, 18: 15879
radiation effects on immune reactions in, 18: 15881

RADAR
use of weather, for fallout prediction, 18: 16202(R) (AD-416645)

RADIATION
annealing effects on neutron irradiated ammonium and potassium dichromates, 18: 16114
book: *High Sensitivity Counting Techniques*, 18: 16354
book: *Radiation Effects on Solids*, 18: 16539
book: *Radionuclides*, in German, 18: 16380
dose to tissues, film dosimeter method for, 18: 16263
doses to CERN synchrotron personnel, 18: 16262
doses, automatic computation of, 18: 16360
doses, method for recording personnel, 18: 16261
doses, methods for measuring, 18: 16260
dosimetry in Canada, advances in, 18: 16363
dosimetry in France, 18: 16267
dosimetry levels, 18: 15910
dosimetry of conference on, 18: 16253
dosimetry of personnel, detection methods for, 18: 16364
dosimetry of personnel, significance of, to biology, 18: 16264
dosimetry practices in the United States, 18: 16265
dosimetry practices in the United Kingdom, 18: 16266
dosimetry practices in Spain, 18: 16268
dosimetry using scintillating plastics, 18: 16366
dosimetry with photographic films, 18: 16257
dosimetry, biological methods for, 18: 16259
dosimetry, film holder for personnel, 18: 16258
dosimetry, photographic film for personnel, 18: 16256
dosimetry, review of methods for personnel, 18: 16365
effects on diffusion in solids, 18: 16543
effects on growth of Walker's tumors in hibernating rats, 18: 15878
effects on learning performance in monkeys, 18: 15853
effects on polymers, molecular distribution in, 18: 16123
effects on rat weight, relation to reproduction and season, 18: 15760
effects on response to stimulus of monkeys, 18: 15849
effects on response of monkeys to training, 18: 15850
effects on response to stimulus of monkeys, whole-body and head exposure, 18: 15851
effects on response to stimulus of monkeys, 18: 15852
effects on response to hemorrhagic stress in dogs, acute and chronic, 18: 15886
emission from argon arcjet, measurement with collimated radiation probe, 18: 17138
human genetic and somatic hazards from, survey, 18: 16251
human radiation exposure from natural, 18: 16212
induction of rabbit cataracts, 18: 15944
method for dose assessment using bone marrow distribution, 18: 15847
pathology of, review, 18: 15859
pneumonitis induced by, in man and rabbits, 18: 15889
scattering of point-source, 18: 16796
spectral effects on nitrogen di- and trioxides in lead nitrate, 18: 16087

RADIATION CHEMISTRY
mechanisms in inorganic compound radiolysis, 18: 16119
of aliphatic acids and salts, electron spin resonance spectra of free radicals in, 18: 16091
of chloropromazine in aqueous solutions, 18: 16092
of cyclohexane, linear electron transfer effect in, 18: 16102
of methyltrideuteriomethylphenylcarbinyl hypochlorite, deuterium isotope effects and transition state in methyl radical formation in, 18: 16086
of plutonium hexafluoride, effects of fluorine, helium, krypton, and oxygen, 18: 16076 (ANL-6812)
of stannic chloride and toluene mixtures, chlorotoluene yields in, 18: 16094
of water vapor, formation of molecular hydrogen in, 18: 16105

RADIATION DAMAGE
theory of, for solids, 18: 16544

RADIATION DETECTION INSTRUMENTS
absorbed dose measurement by, 18: 16364
book: *High Sensitivity Counting Techniques*, 18: 16354
book: *Radionuclides*, in German, 18: 16380
design criteria for modification of fixed monitoring instrumentation in Hanford production reactor areas, 18: 16297 (HW-79027)
development of, using tunnel diodes, 18: 16310(T) (SC-T-64-46)
efficiency, 18: 17246
efficiency of, dead time effects on, 18: 16349
electronic system for rejection of long-range particles in nuclear de-excitation by, 18: 16951(R) (TID-20311)
for fast neutron flux detection, design, 18: 16362
for neutron dosimetry, 18: 16355
for recording personnel doses, 18: 16261
performance comparison of Hurst proportional counter, single-sphere instrument, and multisphere method for neutron dose measurements, 18: 16299 (LAMS-2977)
response of military radiacs to gamma radiation fields, effects of operator on energy-directional, 18: 16309 (USNRDL-TR-701)
summary, 18: 17375
use in adjusting cyclotron beam, 18: 16618
use in radioactivity alarm systems, 18: 16273(P)
use in Spain, 18: 16268
use in the United Kingdom, 18: 16266

RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
design for discrimination between alpha and beta radiations, 18: 16372(P)
design for locating gamma beam centers, 18: 16350
design using Geiger tube for radiation indication at remote point, 18: 16369(P)
development of Geiger counter probe for localization of phosphorus-32 in gastrointestinal tumors, 18: 15929
efficiency of boron fluoride filled, 18: 16891(R) (GA-4881)
pulse analyzers for G-M, design of transistorized, 18: 16345
pulse analyzers with memory devices for, 18: 16340

RADIATION DETECTORS
design and performance of fixed filter paper alpha air monitor, 18: 16298 (K-1589)
performance evaluation for human-body counting, 18: 16244
performance of, in conjunction with multidimensional analyzers, 18: 16321

RADIATION EFFECTS
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
channeling effects on, 18: 16537
on conductance and replacement currents in coaxial cables, 18: 16522 (AD-429954)
on uranium-based reactor fuel materials, bibliography on, 18: 16529

(VDIT-16(4.1))
RADIATION INJURIES
genetic effects of, in mice, 18: 15810(R) (LAMS-3034(p.129-32))
of respiratory tract in man and rabbits, pathology of, 18: 15889
of thoracic tissues after radiotherapy of tumors, 18: 15888
pathology of, in mouse cerebellum, 18: 15830
protection against, use of gallates for, 18: 15896(T) (JPRS-23834)
RADIATION MONITORING
equipment, 18: 16312
of air and water in vicinity of Feed Materials Production Center in 1963, 18: 16233(R) (TID-20368)
RADIATION PROTECTION
book: *Anti-Radiation Properties of Gallates*, 18: 15904
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
development of guides for, by Federal Radiation Council, 18: 15911
human-body counter development for, 18: 16244
measures for eye diagnosis and therapy, 18: 15944
methods and equipment for, 18: 16223 (JAERI-5012)
of uranium mine personnel, 18: 16240
programs on, data from, 18: 16229 (NP-13760)
role of state agencies in, 18: 16269
standards for nuclear installations, 18: 16254
standards, problems in application of, 18: 16255
RADIATION SICKNESS
protective effects of acidophilous milk with lactose against, in rats, 18: 15903
RADIATION SOURCES
design of isolated, for ionization detectors, 18: 16319
preparation of iron-55, 18: 16404
RADIATION TARGET CANS
fabrication, 18: 17351(R) (BMI-1659(Del.))
RADIATION TARGETS
feasibility of neutron-gas, for accelerator application, 18: 16600 (BNL-7534(p.406-13))
production of titanium–deuterium and titanium–tritium, equipment for, 18: 16461
RADIO ASTRONOMY
observation of solar type radio burst from flare star, 18: 16638
RADIO WAVES
absorption in ionospheric polar cap, occurrence statistics of, 18: 16824
absorption in ionospheric polar caps, origins of blackouts from, 18: 16826
absorption in ionosphere at 12 Mc during polar cap events, 18: 16827
absorption in ionospheric D-region, effects of type-IV radio-burst solar flares on, 18: 16834
effects of solar disturbances on, conference on, 18: 16822
emission of Jovian decameter, field-aligned duct model for, 18: 16646
frequency phase changes in ionospheric F2 layer, Doppler study of, 18: 16833
propagation at oblique incidence in east-west U. S. path, effects of magnetic disturbances on, 18: 16837
propagation at oblique incidence, effects of solar flares on, 18: 16840
propagation by ionospheric F2-layer for 4000 km at 15 Mc, daytime effects on, 18: 16838
propagation disturbances during high solar activity, 27-day recurrence of, 18: 16843
propagation in high-latitude path in ionosphere, effects of solar disturbances on, 18: 16830
propagation in ionosphere during polar blackouts at 12 and 18 Mc, 18: 16828
propagation in ionospheric D-region, effects of solar disturbances on, 18: 16841
propagation in ionosphere, Doppler effects on, 18: 16876
propagation of h-f, across polar regions, solar flare effects on, 18: 16831
propagation of ionospheric h-f, solar radiation effects on, 18: 16825
propagation of vlf, effects of polar blackouts on, 18: 16829
propagation of 50-Mc, effects of solar disturbances on ionospheric, 18: 16839
propagation of, effects of ionospheric storms on, 18: 16844
properties of radio aurorae at high latitudes, 18: 16861
reflection by ionosphere, effects on solar disturbances on, 18: 16846
scattering by ionosphere, effects of sudden ionospheric disturbances on back-, 18: 16836
scattering by ionosphere, storm morpholigic diagnostics from, 18: 16835
scattering in ionosphere during aurorae, multiple, 18: 16875
RADIOACTIVE CONTAMINATION
monitoring apparatus with discrimination means for alpha and beta radiations, 18: 16372(P)
RADIOACTIVE MATERIALS
hazards of various, 18: 16241
RADIOACTIVE MINERALS
prospecting for, effects of fallout activity on field measurements in, 18: 16220
RADIOACTIVITY
book: *Radiation Hygiene. Vol. II. Public Health*, 18: 16252
book: *Radioactive Transmutation of Nuclei and Atomic Shells*, in Russian, 18: 17096
decay of heavy-element, estimation of galaxy chronology from, 18: 16639
monitoring in air, design of alarm system for, 18: 16273(P)
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
monitoring of, in building and vault after nuclear excursion of critical assembly, 18: 16242
of marine organisms in sea water, survey, 18: 17335 (NP-13756(Vol.II))
scanning animals, design of system for, 18: 15763 (ACRH-20(p.136-43))
RADIOAPPLICATORS
design of strontium-90–yttrium-90 needle, 18: 15912(R) (ACRH-20(p.25-36))
development of phosphorus-32 chromic phosphate, for implantation irradiation of urethra, 18: 15935
RADIOBIOLOGY
advantages of insects as experimental animals for, 18: 15756
hit theory in, refutation of, 18: 15865
proton source for use in, 18: 15866
research activities at Los Alamos, July 1962 to July 1963, 18: 15736(R) (LAMS-3034)
RADIOCHEMICAL PROCESSING PLANTS
economics, operation, and safety of, review of, 18: 16151
RADIODIAGNOSIS
arm counting and rapid screening methods of, for detection of chronic myelogenous leukemia by abnormal vitamin B_{12} binding, 18: 15914 (TID-7689(p.11-14))
human genetic and somatic hazards from, survey, 18: 16251
iodine-125 measurement techniques in, evaluation of, 18: 15915 (TID-7689(p.15-16))
of bone tumors by scanning after administration of strontium-85, 18: 15932
of brain tumors by scanning after administration of gallium-68, 18: 15931
of brain tumors by positron scanning after administration of iodine-124-labeled gamma globulin, 18: 15933
of brain tumors, evaluation of radioisotope encephalography for, 18: 15937
of eyes, protective measures during, 18: 15944
technetium-99m uses in, 18: 15913 (TID-7689(p.1-11))
use of iodine-131 for, dosimetry, 18: 15941
using iodine-131, dose to children from, 18: 15939
RADIOELECTRIC CELLS
design and performance using alpha-particle energy conversion, 18: 16745
RADIOFREQUENCY SPECTROMETERS
design for EPR and spin-lattice relaxation measurements, 18: 16342
RADIOGRAPHY
dental, survey in Jefferson County, Alabama, 18: 16247
development of x-ray technique for coated fuel particles, 18: 17291
diagnostic, equipment development for low-dose fluoro-, 18: 15936
evaluation of equipment and materials, ICRU recommendations for methods for, 18: 16279 (NP-13746)
radiation exposure during diagnostic and dental, population survey on, 18: 16248
radiation intensity reduction methods in isotopic, 18: 15918 (TID-7689 (p.29-30))
techniques in, comparison of, 18: 15930

RADIOISOTOPES
book: *Decay Scheme of Radioactive Nuclei A ≥ 100*, 18: 17099
book: *Radionuclides*, in German, 18: 16380
conference on applications of, 18: 16382 (TID-7688)
conference on, Oak Ridge, ORINS and ORNL, April 19 to 22, 1964, 18: 16378 (TID-7689)
determination in human body, development of counter for, 18: 16244
determination measurements in scanning internal organs, comparison of analog and digital methods of recording, 18: 15917 (TID-7689(p.25-8))
determination of beta-emitting, in water, 18: 15982
maximum allowable concentrations in streams for flowrate studies, 18: 15905 (TID-7689(p.34-7))
maximum permissible body burdens of, for man, biological factors affecting, 18: 15908
migration and retention in soils, conference on, 18: 17336
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
movement in clay soils, physico chemical reactions in, 18: 16208
movement in soil, Belgian studies on, 18: 17341
movement in soils, geologic and hydrologic studies on, 18: 16207
movement in soils, method for study of, 18: 16216
production by irradiation of target materials, 18: 16401 (ZFK-RCH-1)
production of carrier-free neutron-deficient, in ORNL cyclotron, 18: 16399 (TID-7688(p.5-7))
retention by sand and soft soils, device for measuring, 18: 16215
separation from waste solutions by ion exchange, 18: 17332(R) (HW-80526)
use for measuring vacuums, 18: 16395
uses in marine biology research, 18: 15748 (TID-7689(p.69-72))
uses in underwater acoustic beacon, 18: 16397 (TID-7689(p.72-6))
RADIOLOGICAL WARFARE
civilian defense during, organization and training of physicians for, 18: 16245
RADIOLOGY
evaluation of equipment and materials, ICRU recommendations for methods for, 18: 16279 (NP-13746)
liquid scintillation detector for, design of, 18: 16375(P)
pediatric, short exposure times in, 18: 15940
RADIOMETRIC ANALYSIS
book: *Radiochemical analysis*, 18: 15992
of bones for cesium-137 and potassium-40, effects of ashing temperature on results of, 18: 15953(R) (LAMS-3034(p.201-4))
of urine, sample preparation and counting methods for, 18: 15987
of urine, sample preparation for, 18: 15988
of urine, sample preparation for, 18: 15989
of urine, using autoradiography of paper chromatograms, 18: 15989
RADIOMIMETIC SUBSTANCES
E. coli resistance to proflavine, 18: 15844
mutagenic and toxic effects on *Neurospora crassa*, 18: 15869
RADIOPROTECTIVE COMPOUNDS
book: *Anti-Radiation Properties of Gallates*, 18: 15904
preparation of disulfide compounds as, 18: 15895(R) (NP-13730)
use of gallic acid esters as, 18: 15896(T) (JPRS-23834)
RADIOSENSITIVITY
effects of 5-BUDR on *E. coli*, 18: 15898
gene controlling *E. coli*, analysis of, 18: 15846
of *B. subtilis* dehydrogenases and transaminases, 18: 15845
of catalases, effects of sugars on, 18: 15900
of *E. coli*, uv, 18: 15844
of mammalian cells, effects on natural radioprotective substances on, 18: 15897
of mice, effects of age on, 18: 15807(R) (LAMS-3034(p.112-15))
of mice, effects of ancestral irradiation on, 18: 15810(R) (LAMS-3034 (p.129-32))
of Pseudomonas, relation to enzyme production, 18: 15871
of rats, effects of hypothermia on, 18: 15887
RADIOSTERILIZATION
of barley malt, effects on quality, 18: 15841
of foods infected with Salmonella, gamma, 18: 15854
of meat, oxidation-reduction in, 18: 16381 (NP-13619)
of milk, effects on flavor of fats, 18: 15848
of soils, 18: 15885
RADIOTHERAPY
dose distribution in electron grid, 18: 15943
effects on sex ratio shifts, x, 18: 15823
effects on tissue during subsequent surgery, 18: 15942
for diabetes, alpha and proton, 18: 15927
iodine-125 measurement techniques in, evaluation of, 18: 15915 (TID-7689(p.15-16))
of endometrial carcinoma using radium, survey on 610 cases of, 18: 15920
of eyes, protective measures during, 18: 15944
of leukoplakia of urethra using phosphorus-32 chromic phosphate implantation, 18: 15935
of oral cancer, effects on mouth and jaws, gamma and radium, 18: 15921
of oral tumors, development of osteomyelitis of jaws after, 18: 15860
of ovarian carcinoma, development of radiation nephritis after, 18: 15862
of thoracic tumors, chest lesions induced by, 18: 15888
of thyroid diseases using iodine-131, effects on parathyroid function in man, 18: 15926
of thyroid, gastrointestinal absorption of iodine-131 after, 18: 15791
of uterine carcinoma after surgery, fistula development after, 18: 15839
protective effects of adenine during, 18: 15902
use of iodine-131 for, dosimetry, 18: 15941
using electrons at 15-Mev, 18: 15923
using linear accelerators, physical aspects of, 18: 15922
RADIUM
separation from clay by leaching using aqueous solutions of calcium chloride or sodium carbonate, 18: 16133
technicians using, device for dose reduction to, 18: 15924
therapy for oral cancer, effects of, on mouth and jaws, 18: 15921
use of treatment of endometrial carcinomas, survey on 610 cases, 18: 15920
RADIUM ISOTOPES Ra-223
desorption from stainless steel, 18: 16376(R) (MLM-1157)
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
RADIUM ISOTOPES Ra-224
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
RADIUM ISOTOPES Ra-226
alpha spectrography of, 18: 16984
content in coal and surface waters of Australia, 18: 16211
deuteron fission of, energy distributions from, 18: 17100
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
RADON
diffusion through films of plastics, rubbers, and rubber vulcanizates, 18: 16550 (TID-7688(p.64-7))
RADON ISOTOPES Rn-218
energy level distributions in, 18: 16984
RADON ISOTOPES Rn-220
energy level distributions in, 18: 16984
half life of, method for determination of, 18: 17086
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
RADON ISOTOPES Rn-222
energy level distributions in, 18: 16984
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
RAIN WATER
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
analysis for strontium-90, method for, 18: 15958 (SCPRI(S)-81)
monitoring for fallout in, in Canada, 18: 16229 (NP-13760)
RARE EARTH FLUORIDES
chemical properties and crystal structure of, effects of temperature on, 18: 16013
RARE EARTH OXIDES
electric properties, 18: 17370(T) (SC-T-64-44)
RARE EARTHS
determination of traces of, in uranium metal, spectrographic, 18: 15950 (EUR-587.e)
separation by solvent extraction using butyl phosphates, 18: 16157(P)
separation of lanthanide, in ammonium nitrates by partial crystallization, 18: 16137
RARE GAS COMPOUNDS
preparation and properties of, review on, 18: 16050
RARE GASES
charge transfer cross sections for, resonant, 18: 16708
electron inelastic collisions and mobility in, 18: 16668
electron scattering by, structure beyond ionization limit in inelastic,

18: 16697
ionization by electron impact, cross sections for, 18: 16696
lifetime of excited states of, 18: 16721
molecular ion formation in, by reactions of excited and normal atoms, 18: 16721
proton energy losses in, 18: 16713
RATE METERS
design, 18: 16312
recording system for, development of, for use with rapidly changing radioactive counting rates, 18: 16311
response of military radiacs to gamma radiation fields, effects of operator on energy-directional, 18: 16309 (USNRDL-TR-701)
RATS
barium-133 and calcium-45 uptake by embryonic bones of, 18: 15803
beryllium-7 metabolism in, 18: 15769(R) (LAMS-3034(p.59-64))
brain development in, comparison of effects of nitrogen mustard and x rays on, 18: 15834
cesium-137 excretion and muscle cell retention, comparison with potassium, 18: 15783 (TID-7689(p.55-8))
dentin mineralization in teeth of, effects of injected fluoride, parathyroid extract, or strontium on, 18: 15792
effects of nitrogen mustard on morphology and physiology of spleen in, 18: 15822
effects of survival food diet on, 18: 16237
immunological effects of steroid sex hormones in, 18: 15752
iron-59 uptake by tibia of, effects of erythropoietin on, 18: 15797
manganese-54 metabolism in, 18: 15767(R) (LAMS-3034(p.49-52))
metabolism of zinc-65 in, effects of dietary levels of copper and molybdenum on, 18: 15794
radiation effects on weight of, in relation to reproduction and season, 18: 15760
radiation effects on hemagglutination-inhibiting antibody production in, beta and gamma, 18: 15820
radiation effects on morphology and physiology of spleen in, 18: 15822
radiation effects on central nervous system in, x, 18: 15836(T)
radiation effects on spleen in, early, 18: 15863
radiation effects on immunological restoration by thymus in, 18: 15869
radiation effects on lymphocytes of, gamma, 18: 15872
radiation effects on creatinine excretion in thyroparathyroidectomized, x, 18: 15876
radiation effects on embryos of, maternal role in, x, 18: 15894
radiation sickness in, protective effects of acidophilous milk with lactose against, 18: 15903
radioinduced polydipsia in, age effects on protons, 18: 15815 (USNRDL-TR-712)
radiosensitivity and growth of Walker's tumors in hibernating, 18: 15878
radiosensitivity of, effects of hypothermia on, 18: 15887
serotonin content of, brain of, behavior effects of, 18: 17364 (UCRL-11179)
thyroid metabolism of iodine in, effects of chlordiazepoxide on, 18: 15787
thyroid metabolism of iodine in, effects of serotonin on, 18: 15789
thyroid physiology in, effects of chlordiazepoxide on, 18: 15788
tritium-labeled vinblastine excretion by, 18: 15790
REACTION MECHANISMS
in catalytic deuteration of alkyl benzenes, *π*-complexes, 18: 16040
REACTOR COMPONENTS
design of megawatt-hour meter for registering reactor energy release, 18: 17261 (ZFK-RN-8)
REACTOR CONTROL RODS
worth of, method for calculating, 18: 17259 (NP-13659)
REACTOR CONTROL SYSTEMS
design, 18: 17325 (NP-13710)
servosystems for, equations of, 18: 17263
REACTOR COOLANTS
monitoring system for, engineering drawings of, 18: 16288
use of hydrocarbons as, 18: 17257(P)
REACTOR COOLING SYSTEMS
design for pressurized-water reactor using heavy water–light water mixtures, 18: 17269(P)
design for swimming pool reactors, 18: 17331(P)
pump breakdown in pressurized-water, 18: 17267
radioactivities in N.S. *Savannah*, during startup and early operation, 18: 17320 (NSEC-72)
REACTOR ENGINEERING
blast effects on reactor containment vessel models, internal, 18: 17258 (BRL-Memo-1530)
book: *Constants in Nuclear Physics*, 18: 17255
inelastic deflection of fuel plates due to coolant flow and compressive edge loads, 18: 17292
pressure vessel structural problems in, 18: 17262
REACTOR FUEL ALLOYS
corrosion resistance of molybdenum/niobium–uranium, improvement by platinum additions, 18: 16449(P)
REACTOR FUEL ELEMENTS
alpha monitoring of EBR-I Mark IV plutonium, 18: 17309
design of compartmented, 18: 17295(P)
development and pore distribution of fine-grained graphite for use as, 18: 16465 (AERE-R-3943)
handling and transportation of irradiated, technical progress review on, 18: 16151
handling, shipping, and storage of irradiated, 18: 16238
inspection of irradiated plutonium, cells for, 18: 16163 (CEA-2395)
loading and unloading in reactor, development of apparatus and method for, 18: 17271(P)
power generation in fast, EOCR modification for increased, 18: 17247 (APDA-158)
processing of irradiated, radiation effects on solvent extraction methods for, 18: 16143
processing of irradiated, technical progress review on nonaqueous, 18: 16153
REACTOR FUEL ELEMENTS (CERAMIC)
cladding, 18: 17290(T) (AEC-tr-6359)
design, 18: 17294(P)
development of carbide, 18: 16426(R) (UNC-5068)
development of uranium dioxide, with burnable poisons, 18: 16468(R) (CEND-203)
fabrication for Plutonium Recycle Test Reactor Mark I-M, specifications for, 18: 16452 (HW-79290)
fabrication of thorium–uranium-233 oxide, Kilorod facility for, 18: 16455 (ORNL-3539)
fabrication of vibrationally compacted plutonium oxide–uranium oxide, for PRTR, specifications, 18: 16453 (HW-79291)
fabrication with boron carbide poison, 18: 16427 (WAPD-244)
inspection of coated-particle X-ray microscopy applied to, 18: 17291
oxidation of irradiated graphite-matrix, 18: 16152
processing of carbide and oxide, development of methods for, 18: 16153
processing of irradiated, preparations for, 18: 16152
processing of, criticality studies for, 18: 16736 (HW-79413)
properties for use in Rapsodie, 18: 17290(T) (AEC-tr-6359)
properties of boron carbide–uranium dioxide, 18: 16468(R) (CEND-203)
testing, 18: 17351(R) (BMI-1659(Del.))
REACTOR FUEL ELEMENTS (DISPERSION)
analysis for uranium-235, automatic gamma scanner for, 18: 17265
fabrication of silicon carbide-coated, for pebble-bed reactor, 18: 17293(P)
review, 18: 17289 (CEA-Bib-41)
REACTOR FUEL PINS
fluid flow in assemblies of, friction factors for isothermal turbulent, 18: 17253
REACTOR FUEL PLATES
stress loading of, prediction of inelastic deflection due to coolant flow and compressive edge loads, 18: 17292
REACTOR FUELS
analysis of irradiated and unirradiated, literature review, 18: 15960 (SGAE-PH/CH-1/1964)
processing of irradiated, 18: 16130(T,R) (EURAEC-789)
processing of irradiated, Technical Progress Review, Winter 1963–64, 18: 16150
processing of irradiated, technical progress review on, 18: 16151
processing of irradiated, technical progress review on aqueous, 18: 16152
purification of, development of liquid-metal and salt processes for, 18: 16153
radiation effects on uranium-based, bibliography on, 18: 16529 (VDIT-

16(4.1))
testing of coated-particle, 18: 17351(R) (BMI-1659(Del.))
REACTOR MATERIALS
development, 18: 17351(R) (BMI-1659(Del.))
neutron cross sections, 18: 17287 (NP-13666)
radiation effects testing, methods for, 18: 16526 (NP-13663)
REACTOR MATRICES
core performance in boiling reactor, effects of twisted tapes on, 18: 17251(T) (EURAEC-931)
critical experiments on slightly enriched uranium metal fuel elements in graphite lattices, 18: 16739 (NAA-SR-7541)
criticality studies of ceramic fuel–water, for German zero reactor, 18: 17281 (ZFK-TPH-5)
fluid flow in several geometries, friction factors for isothermal turbulent, 18: 17253
neutron flux densities in lattice cells, boundary conditions for gap geometry, 18: 17256
neutron flux distributions in concentric fuel annuli, one-group collision-probability calculations for, 18: 17252
REACTOR MODERATORS
physics of graphite, effects of choice of moderator scattering law on, 18: 17266
REACTOR REFLECTORS
neutron backscattering by plane and spherical, 18: 16896 (NP-13720)
REACTOR SAFETY
rules for construction of nuclear-powered ships, 18: 17321 (RTI/ING(63)-5)
REACTOR SIMULATORS
design and performance for automatic reactor calculations, 18: 17250 (PAN-O-117)
REACTORS
channel plugs, device for anchoring and extracting, 18: 17272(P)
core models for, review of, 18: 17279 (KAPL-M-JDJ-1)
energy release from, apparatus for measuring, 18: 17261 (ZFK-RN-8)
experimental determination of β^{eff}/l, 18: 17284
fuel depletion calculations for, computer program for, 18: 17280 (WCAP-6059)
kinetics of, approaching criticality, 18: 17283
multiplication factor in cylindrical symmetry, fast, 18: 17282(T) (CEA-tr-X-319)
neutron diffusion in, solution of spatio-temporal equations for, 18: 16890 (EUR-596.e)
physics of, research program on, 18: 17286
power measurement, thermal neutron detecting apparatus for, 18: 16371(P)
review, 18: 17375
use as neutron-target source for accelerator beams, feasibil 18: 16600 (BNL-7534(p.406-13))
RECTIFIERS
design of ignition with elimination of arc transfer to wall, 18: 16285
REDOX PROCESS
wastes from, processing of, 18: 17332(R) (HW-80526)
REFRACTORY MATERIALS
stress-rupture data on metallic, 18: 16424(R) (GEMP-270A)
Ta–W, weld parameters of, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
RELATIVITY THEORY
causality principle, deduction of Lorentz group from, 18: 16805
Einstein field equations in, effects of variational principle for dynamic processes on, 18: 16571
energy partition in cosmical physics, 18: 16815
equations for perfect gases in general, 18: 16570
space-times with bounded empty regions, 18: 16816
REMOTE-CONTROL EQUIPMENT
design of Kilorod facility for fabricating thorium–uranium-233 oxide fuel rods, 18: 16455 (ORNL-3539)
RESEARCH REACTORS
control of pulsed, 18: 17325 (NP-13710)
criticality studies and testing of Japanese, 18: 16223 (JAERI-5012)
description of Scottish Research Reactor Center, 18: 17327
irradiation progam of Ispra-1, 18: 17328
loading facilities for Diorit, 18: 17329
neutron spectra in UTR-10, cross-power measurements of, 18: 17330
reactivity of, formulas for, 18: 17285
RESPIRATION
radiation effects on Saccharomyces, x, 18: 15819(T) (UCRL-Trans-1029)
RESPIRATORY TRACTS
book: *Pulmonary Deposition and Retention of Inhaled Aerosols*, 18: 15806
physiological response to inhaled aerosols, 18: 15806
radiation effects on, in man and rabbits, 18: 15889
radioinduced lesions of, after radiotherapy of thoracic tumors, 18: 15888
RHENIUM
creep-rupture of sheet, at 2600°C, 18: 16424(R) (GEMP-270A)
determination in rhenium-tungsten alloys, intensity ratio technique for x ray spectrometric, 18: 15972
radiation effects on mechanical properties of, 18: 16424(R) (GEMP-270A)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
RHENIUM ALLOYS
Al–Cr–Re, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Cr–Re, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Mo–Re–W, mechanical properties of, effects of composition on, 18: 16424(R) (GEMP-270A)
Re–W, creep and stress-rupture at 2200 to 2600°C, 18: 16424(R) (GEMP-270A)
Re–W, intensity ratio technique for x-ray spectrometric analysis for rhenium and tungsten in, 18: 15972
Re–W, radiation effects on electric and mechanical properties of, 18: 16424(R) (GEMP-270A)
RHENIUM COMPLEXES
existence of binuclear, 18: 17355(R) (MIT-1965-7)
structure of cluster, 18: 17355(R) (MIT-1965-7)
RHENIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
RHENIUM ISOTOPES Re-188
preparation and properties of, for use as neutron sources, 18: 16379
RHODAMINE B
use in tracer study of dilution in Ottawa River, 18: 16196
RHODIUM
alpha reactions (α,p) at 42 Mev, angular distributions of protons from, 18: 16951(R) (TID-20311)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
RHODIUM ALLOYS
Fe–Rh, effects of low temperature on electric conductivity, 18: 16511
Rh–Tc, structure, 18: 16489
RHODIUM ISOTOPES Rh-103
neutron reactions below 800 ev, strength functions from, 18: 17032
RHODIUM ISOTOPES Rh-104
beta decay scheme of ground state of, 18: 16989
RHODIUM ISOTOPES Rh-106
migration and fixation in silt and soils, 18: 17345
separation from fission products by amalgam exchange, radiochemical, 18: 16148
RIBONUCLEIC ACID
synthesis and chemical structure of, 18: 15805
uridine uptake by, effects of thymidine on, 18: 15802
RIBONUCLEIC ACID, DESOXY-
analysis of data on ultracentrifugal molecular weights and sedimentation coefficient distributions for, computer program for, 18: 15778(R) (LAMS-3034(p.319-25))
dark reactivation of ultraviolet-irradiated, from bacteriophage, 18: 15832
radiation effects on synthesis of, in virus-infected tissue culture cells, 18: 15835
separation from bacteria, 18: 15776(R) (LAMS-3034(p.288-95))
separation from bacteriophage, 18: 15777(R) (LAMS-3034(p.296-302))
synthesis and chemical structure of, 18: 15805
uridine uptake by, effects of thymidine on, 18: 15802
ROCKET MOTORS
ion beam extraction from plasma source for, 18: 17240
ion engine exhaust effects on telemetry systems, 18: 16286
ion thrustor use in satellite control systems, 18: 16582

ion, characteristics of surface-contact Hall-current accelerator for, 18: 16559
ion, performance of two-stage repetitively fired coaxial plasma gun for, 18: 17140
ROCKET REACTORS
magnetohydrodynamic species separation in gaseous-core, 18: 17323
ROCKETS
leak detection in Saturn, tracer technique for, 18: 16392 (TID-7688(p.95-7))
research program of U.S. IGY-IGC, third compilation, 18: 16580
ROCKS
fracturing of, tracer studies of, 18: 16194 (TID-7689(p.105-18))
neutron emission by, 18: 16209
RODS
flow of air–water mixtures on four-rod assembly, effects of twist strips on pressure drop and vacuum fraction in, 18: 16182(T) (EURAEC-638)
ROOTS
mineral transfer in hardwood forest by, tracer studies of, 18: 15757 (TID-7689(p.62-5))
rubidium-86 uptake by maize, effects of diffusion on, 18: 15801
RUBBER
diffusion of radon and tritium through films of vulcanizates of, 18: 16550 (TID-7688(p.64-7))
properties of, relation to structure, 18: 17371(T) (SC-T-64-45)
RUBIDIUM
determination in stony meteorites, activation and mass spectrometric, 18: 15976
ionization of, Auger effect in, 18: 16698
ionization of, fractional, 18: 17121(R) (TID-20362)
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
vapor pressure of, correspondence with cesium, mercury, potassium, and sodium, 18: 16035
RUBIDIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
RUBIDIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
RUBIDIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
RUBIDIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
RUBIDIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
RUBIDIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
RUBIDIUM ISOTOPES Rb-86
absorption and diffusion in kaolinite and soil, 18: 16199
diffusion and uptake in maize roots, 18: 15801
RUBIDIUM ISOTOPES Rb-88
preparation and properties of, for use as neutron sources, 18: 16379
RUSSIAN REACTORS
reactivity of, formulas for, 18: 17285
RUTHENIUM
exchange reactions between deuterium and methane on, catalytic, 18: 16034
ion exchange in soils, 18: 17342
movement in bed of White Oak Lake, Oak Ridge, Tenn., 18: 17348
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from nitric acid, properties of TBP for, 18: 16377(R) (ORNL-TM-515)
separation from other fission products by sorption on silica gel, 18: 16144
separation from Purex waste solutions using Alamine-336, 18: 16377(R) (ORNL-TM-515)
separation of aluminum, cerium, and strontium from, using D2EHPA, 18: 16377(R) (ORNL-TM-515)
RUTHENIUM ALLOYS
Pt–Ru, catalytic exchange reactions between deuterium and methane on, 18: 16034
RUTHENIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
RUTHENIUM ISOTOPES Ru-101
energy levels at 125 and 320 kev, properties of, 18: 17014
RUTHENIUM ISOTOPES Ru-106
migration and fixation in silt and soils, 18: 17345
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
movement in clay soils, physico chemical reactions in, 18: 16208
separation from fission products by amalgam exchange, radiochemical, 18: 16148

S

SAFETY
hazards of various radioactive materials, 18: 16241
SAFETY HAZARDS
evaluation of, in shipping cask for irradiated PM-1 and PM-3A cores, 18: 16225 (MND-M-1856)
in handling, shipping, and storage of irradiated fuel elements, 18: 16238
SAMARIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from gadolinium and ytterbium by zone crystallization in nitrate medium and by precipitation using ammonium oxalate, 18: 16137
separation from lanthanum by zone crystallization in nitrate medium and by precipitation using ammonium sulfate, 18: 16137
SAMARIUM FLUORIDES
$NH_4F–SmF_3$, chemical properties and crystal structure, 18: 16013
SAMARIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
SAMARIUM ISOTOPES Sm-149
neutron reactions at 0.1 to 0.9 ev, resonances in, 18: 17037
SAMARIUM ISOTOPES Sm-151
gamma transitions in, internal conversion spectra from, 18: 17017
SAMARIUM ISOTOPES Sm-152
half life of first excited state of, 18: 16986
SAMPLING
of fallout, in high-altitude balloon flights, 1963, 18: 16203(R) (NYO-10496)
SANDS
radioisotope permeability and retention in, device for measuring, 18: 16215
SAP (SINTERED ALUMINUM PRODUCTS)
analysis for aluminum, 18: 15949 (EUR-585.i)
corrosion by water at 260 to 350°C, 18: 16438 (ANL-6785)
creep-rupture properties of M-257, M-583, 895, and 915, at 700, 800, and 900°F, 18: 16467(R) (BMI-X-277)
creep-rupture testing, 18: 17351(R) (BMI-1659(Del.))
SAPPHIRES
electron transmission at 1 to 8 Mev, 18: 17244 (NASA-SP-3008)
SARCOMAS
radiation effects on cells of, in tissue culture, deuteron, 18: 15829
SATELLITES
control system for synchronous, use of ion thrust devices for, 18: 16582
SCALERS
data recording system design for Harwell solid-state, 18: 16275 (AERE-M-1332)
design of bi-directional decade counter with anti-coincidence network and digital display, 18: 16313
SCANDIUM
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
scandium-45 nuclear magnetic relaxation in, 18: 16563
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
solvent partition in hexone–hydrochloric acid–8-quinolinol with DBBP and TOPO, 18: 16134
SCANDIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017

SCANDIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
SCANDIUM COMPLEXES
with Alizarin Red S, composition, nature, and stability of, 18: 16039
SCANDIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
SCANDIUM ISOTOPES Sc-42
energy levels of, $(f_{5/2})^1$, 18: 16933 (ANL-6848(p.182-7))
SCANDIUM ISOTOPES Sc-45
neutron reactions (n,α) at 14 Mev, 18: 17057
nuclear magnetic relaxation in scandium metal, 18: 16563
SCATTERING
amplitudes for, Coulomb-wave, 18: 16910 (ANL-6848(p.38-42))
amplitudes on unphysical sheets and resonance poles in, 18: 16786
dispersion relations, solution to N/D equations in, 18: 16813
dispersion theory of strong interactions for high-energy, 18: 16747 (BNL-7534(p.49-80))
elastic and inelastic high-energy, 18: 16747 (BNL-7534(p.49-80))
isotropic, of point-source radiation, 18: 16796
model for high-energy, nonlocal, 18: 16784
parity rule for small-angle, 18: 16921 (ANL-6848(p.118-22))
theory of relativistic, 18: 16769
theory of strong interactions at high energies, Regge-pole, 18: 16748 (BNL-7534(p.81-2))
theory of, matrix analytic regularization and divergences in, 18: 16808
theory of, s-matrix, 18: 16552(R) (UCRL-11132)
SCHOEPITES
synthesis, 18: 16009
SCINTILLATION DETECTORS
background reduction in liquid, use of glass light filter for, 18: 16307 (TID-7689(p.31-3))
design for liquid, 18: 16375(P)
design for small animal scanning system, 18: 15763 (ACRH-20(p.136-43))
design of, for dosimetric control of liquid flow, 18: 16374(P)
design of, using plastics, 18: 16366
efficiency for iodine-125 determination in clinical applications, 18: 15915 (TID-7689(p.15-16))
performance in neutron time-of-flight spectrometers, 18: 16323
performance of lithium-6 salicylate, for neutron detection, 18: 16308 (TID-7689(p.103-5))
performance of organic, for discriminating between charged particles, 18: 16324
use for measurement of gastrointestinal absorption of cobalt-58-labeled vitamin B_{12}, 18: 15799
SEA WATER
analysis for radioactivity in France, 18: 16204(R) (SCPRX(RM)-XII-1963)
biological and oceanographical conditions in North Sea, 18: 17334 (NP-13756(Vol.I))
radioactivity of marine organisms in, survey, 18: 17335 (NP-13756 (Vol.II))
SEED
nucleic acid synthesis in barley, 18: 17361(R) (TID-20353)
SEIGNETTOELECTRIC MATERIALS
radiation effects on dielectric properties, 18: 16545
SEISMIC WAVES
detection on ocean bottom, 18: 16198
production by 1962 Christmas Island nuclear explosions, 18: 16546 (AWRE-O-87/63)
propagation of surface, from Hardhat explosion, 18: 16197
SEISMOLOGY
data for CLEARWATER event, long-range, 18: 16189 (AD-427125(Rev.))
data for SHOAL event, local, 18: 16190 (NP-13757)
data from STONES event, long-range, 18: 16191 (NP-13586(Rev.))
SELENIUM
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
radiation effects on crystallization of, 18: 16540
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
SELENIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
SELENIUM ISOTOPES Se-75
separation from fission products by amalgam exchange, radiochemical, 18: 16148
transfer of, across pericardium in dogs, 18: 15804
SELENIUM OXIDES
radiation effects on mechanical properties, 18: 16542
SELENIUM SYSTEMS
AsSeTe, radiation effects on electric conductivity of, 18: 16541
AsSeTl, radiation effects on electric conductivity of, 18: 16541
SEMICONDUCTOR DETECTORS
design and performance of lithium-drifted silicon surface barrier type, with guard ring, 18: 16314
design in combination with amplifier, 18: 16373(P)
performance in neutron time-of-flight spectrometers, 18: 16323
SEMICONDUCTORS
electron temperature in, effect of electric fields on, 18: 16882
impurity problems in, use of radiotracers in study of, 18: 16385 (TID-7688(p.38-40))
radiation effects on electric conductivity of, gamma, 18: 16541
superconductivity in many-valley, 18: 16887
SEPARATION PROCESSES
efficiency of foam, 18: 16129(R) (RAI-116)
equations of, with moving detectors for reactor control, 18: 17263
SHALES
neutron emission by, 18: 16209
SHEETS
effects of pretreatment on adherence of ground-coat porcelain enamel and surface roughness of metal, 18: 16457(T) (AI-Trans-41)
SHELLS
blast effects on reactor containment vessel models, internal, 18: 17258 (BRL-Memo-1530)
contours for toroidal, method for determining meridional, 18: 16164 (ERR-AN-174)
SHELTERS
water supply production from wastes, evaluation of processes for, 18: 16228 (NP-13740)
SHIELDED CONTAINERS
design and construction of lead, 18: 16227 (NP-13691)
design with safety latch, 18: 16274(P)
hazards evaluation of shipping cask for irradiated PM-1 and PM-3A cores, 18: 16225 (MND-M-1856)
SHIELDING
effectiveness in space vehicles, gamma attenuation measurements of, 18: 16231 (TID-7689(p.76-80))
principles and uses, 18: 17375
SHOCK WAVES
electron density and continuum radiation behind, 18: 16648 (NP-13739)
formation in magnetogasdynamic flow, 18: 16560
microwave attenuation by, at Mach 8 to 12, time dependence of attenuation curve for, 18: 16565
production by directed explosions and mechanical impact, 18: 17372(T) (UCRL-Trans-992(L))
reflection of electromagnetically driven, properties of plasmas produced by, 18: 17137
SILICON
analysis for boron, neutron-reaction, 18: 15993
analysis for sodium by gamma spectrometry, 18: 15981
effects on Zircaloy-2 corrosion and hydrogen pickup in steam and water, 18: 16440 (WAPD-283)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron reactions (n,α) at 13.6 to 15 Mev, cross sections for, 18: 16971
preparation for radiation damage studies, 18: 16528 (SC-DC-64-346)
radiation damage and annealing in crystalline, Hall effect measurements of, 18: 16534
radiation damage in uniform avalanche diodes of, neutron, 18: 16528 (SC-DC-64-346)
use as surface barrier detector with guard ring, 18: 16314
x-ray scattering by single crystals of, diffuse bands in, 18: 16551 (TID-20364)

SILICON CARBIDES
melting temperature, evaluation for space technology, 18: 16521
radiation effects on luminescence of, gamma and neutron, 18: 16122
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
B_4C–SiC, corrosion by water at 680°C, 18: 16427 (WAPD-244)
B_4C–SiC, fabrication, 18: 16427 (WAPD-244)
SILICON IONS
spectral line intensities of lithium-like, 18: 17185
SILICON ISOTOPES Si-28
alpha inelastic scattering by, angular correlations in, 18: 16928 (ANL-6848(p.153-8))
deuteron reactions (d,p) with, distributions from polarized, 18: 16617
deuteron scattering by, angular distributions from, 18: 17021
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
proton inelastic scattering by, excited states from, 18: 17042
SILICON ISOTOPES Si-29
deuteron reactions (d,p) with, proton polarization from, 18: 16994
neutron reactions (n,α) with, nuclear properties from, 18: 16995
proton reactions (p,γ) at 1.4 Mev, gamma transitions in, 18: 17059
SILICON ISOTOPES Si-30
proton reactions (p,γ) at 1.00 to 1.53 Mev, angular correlations for, 18: 17080
SILICON ISOTOPES Si-32
production in iron by 730 Mev protons, cross sections for, 18: 17049
SILICON OXIDES
analysis for sodium by gamma spectrometry, 18: 15981
melting temperature, evaluation for space technology, 18: 16521
radiation effects on sorptive properties of, electron-beam, 18: 16117
sorptive properties of colloidal, for fission products, 18: 16144
thermal conductivity of foams of, for use above 3000°F, 18: 16520
Al_2O_3–SiO_2, electric properties, 18: 17370(T) (SC-T-64-44)
SILICON SYSTEMS
Al–Si, effects of thermal cycling on stability of, 18: 16492
Pu–Si, phase studies, 18: 17351(R) (BMI-1659(Del.))
SILICONE RUBBERS
diffusion of radon and tritium through films of, 18: 16550 (TID-7688 (p.64-7))
SILTS
content in rivers and streams, x-ray attenuation gage for measuring, 18: 16195 (TID-7689(p.142))
radioactivity of, from Mediterranean Sea, 1960 to 1963, 18: 15759(R) (TID-20366)
rhodium-106 and ruthenium-106 migration and fixation in, 18: 17345
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
SILVER
argon ion large-angle scattering, 18: 16667
determination in chromium oxide-silver oxide, intensity ratio technique for x-ray spectrometric, 18: 15972
electron reactions with foils of, light emission in, 18: 16649 (ORNL-3485)
neon-20 reactions in emulsion with, models for, 18: 17010
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (AI-Trans-38)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
SILVER CHLORIDES
electric conductivity of thin film in aqueous silver electrolytes, 18: 16005(R) (TID-20354)
morphology of interface between liquid and solid, 18: 16005(R) (TID-20354)
reduction by niobium in fused halides, 18: 16032
SILVER ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
SILVER ISOTOPES Ag-104
hyperfine structure in iron and nickel, 18: 16954 (UCRL-11143)
SILVER ISOTOPES Ag-108
magnetic moment and spin of, measurement of, 18: 17068
SILVER ISOTOPES Ag-109
proton reactions with, nucleon cascades from, 18: 16974
SILVER ISOTOPES Ag-110
decay, 18: 17051
decay and hyperfine structure in iron and nickel, 18: 16954 (UCRL-11143)
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
separation from fission products by amalgam exchange, radiochemical, 18: 16148
SILVER ISOTOPES Ag-111
beta decay of, angular correlations in, 18: 17018
SILVER OXIDES
Cr_2O_3–Ag_2O, intensity ratio technique for x-ray spectrometric analysis for chromium and silver in, 18: 15972
SINGLE CRYSTALS
x-ray scattering by, broad diffuse bands from electron-lattice resonance in, 18: 16551 (TID-20364)
SKIN
radiation effects on sensitivity of, in guinea pigs, 18: 15825
radiation effects on mouse, of heavy charged particles, 18: 15827
SLURRIES
injection of radioactive, in cement, 18: 17346
SODIUM
corrosive effects of liquid, on plutonium nitride, 18: 17351(R) (BMI-1659(Del.))
determination in silicon and silicon oxides by gamma spectrometry, 18: 15981
effects on nitrogen-14 hyperfine coupling constants in EPR spectra of chloronitrobenzene, 18: 16068
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
neutron total cross sections at 2 to 10 Mev, 18: 16973
radiation effects on content of, in rat serum and urine, x, 18: 15842
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
uptake by eye lenses with radioinduced cataracts, 18: 15816(T) (CEA-tr-R-1635)
vapor pressure of, correspondence with cesium, mercury, potassium, and rubidium, 18: 16035
SODIUM ALLOYS
K–Na, effects of impurities on operation of heat transfer system of, 18: 17310
K–Na, heat transfer to copper pipes, 18: 16173 (NP-13656)
SODIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KBr–NaBr, solvent properties for niobium, 18: 16032
SODIUM BRONZE
Na–W, heat capacity and thermodynamics at 15 to 300°K, 18: 16030
SODIUM CARBONATES
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
SODIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
diffusion in glycerol at 32°C, tracer study of, 18: 15998 (TID-7688 (p.52-63))
radiation effects on, low-temperature x, 18: 16106
radiolysis of, mechanism of gamma, 18: 16119
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
$CaCl_2$–NaCl, solvent properties for niobium, 18: 16032
KCl–NaCl, solvent properties for niobium, 18: 16032
$MgCl_2$–NaCl, solvent properties for niobium, 18: 16032
NaCl–K_2NbF_7–ZrF_4, production of niobium–zirconium alloys by electrolysis of, 18: 16431
SODIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KF–NaF–ZrF_4, phase diagram of, liquidus surface in, 18: 16008(T) (ORNL-tr-31)

SCANDIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
SCANDIUM COMPLEXES
with Alizarin Red S, composition, nature, and stability of, 18: 16039
SCANDIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
SCANDIUM ISOTOPES Sc-42
energy levels of, $(I_{\pi/2})\pi$, 18: 16933 (ANL-6848(p.182-7))
SCANDIUM ISOTOPES Sc-45
neutron reactions (n,α) at 14 Mev, 18: 17057
nuclear magnetic relaxation in scandium metal, 18: 16563
SCATTERING
amplitudes for, Coulomb-wave, 18: 16910 (ANL-6848(p.38-42))
amplitudes on unphysical sheets and resonance poles in, 18: 16786
dispersion relations, solution to N/D equations in, 18: 16813
dispersion theory of strong interactions for high-energy, 18: 16747 (BNL-7534(p.49-80))
elastic and inelastic high-energy, 18: 16747 (BNL-7534(p.49-80))
isotropic, of point-source radiation, 18: 16796
model for high-energy, nonlocal, 18: 16784
parity rule for small-angle, 18: 16921 (ANL-6848(p.118-22))
theory of relativistic, 18: 16769
theory of strong interactions at high energies, Regge-pole, 18: 16748 (BNL-7534(p.81-2))
theory of, matrix analytic regularization and divergences in, 18: 16808
theory of, s-matrix, 18: 16552(R) (UCRL-11132)
SCHOEPITES
synthesis, 18: 16009
SCINTILLATION DETECTORS
background reduction in liquid, use of glass light filter for, 18: 16307 (TID-7689(p.31-3))
design for liquid, 18: 16375(P)
design for small animal scanning system, 18: 15763 (ACRH-20(p.136-43))
design of, for dosimetric control of liquid flow, 18: 16374(P)
design of, using plastics, 18: 16366
efficiency for iodine-125 determination in clinical applications, 18: 15915 (TID-7689(p.15-16))
performance in neutron time-of-flight spectrometers, 18: 16323
performance of lithium-6 salicylate, for neutron detection, 18: 16308 (TID-7689(p.103-5))
performance of organic, for discriminating between charged particles, 18: 16324
use for measurement of gastrointestinal absorption of cobalt-58-labeled vitamin B_{12}, 18: 15799
SEA WATER
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
biological and oceanographical conditions in North Sea, 18: 17334 (NP-13756(Vol.I))
radioactivity of marine organisms in, survey, 18: 17335 (NP-13756 (Vol.II))
SEED
nucleic acid synthesis in barley, 18: 17361(R) (TID-20353)
SEIGNETTOELECTRIC MATERIALS
radiation effects on dielectric properties, 18: 16545
SEISMIC WAVES
detection on ocean bottom, 18: 16198
production by 1962 Christmas Island nuclear explosions, 18: 16546 (AWRE-O-87/63)
propagation of surface, from Hardhat explosion, 18: 16197
SEISMOLOGY
data for CLEARWATER event, long-range, 18: 16189 (AD-427125(Rev.))
data for SHOAL event, local, 18: 16190 (NP-13757)
data from STONES event, long-range, 18: 16191 (NP-13586(Rev.))
SELENIUM
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
radiation effects on crystallization of, 18: 16540
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
SELENIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
SELENIUM ISOTOPES Se-75
separation from fission products by amalgam exchange, radiochemical, 18: 16148
transfer of, across pericardium in dogs, 18: 15804
SELENIUM OXIDES
radiation effects on mechanical properties, 18: 16542
SELENIUM SYSTEMS
AsSeTe, radiation effects on electric conductivity of, 18: 16541
AsSeTl, radiation effects on electric conductivity of, 18: 16541
SEMICONDUCTOR DETECTORS
design and performance of lithium-drifted silicon surface barrier type, with guard ring, 18: 16314
design in combination with amplifier, 18: 16373(P)
performance in neutron time-of-flight spectrometers, 18: 16323
SEMICONDUCTORS
electron temperature in, effect of electric fields on, 18: 16882
impurity problems in, use of radiotracers in study of, 18: 16385 (TID-7688(p.38-40))
radiation effects on electric conductivity of, gamma, 18: 16541
superconductivity in many-valley, 18: 16887
SEPARATION PROCESSES
efficiency of foam, 18: 16129(R) (RAI-116)
equations of, with moving detectors for reactor control, 18: 17263
SHALES
neutron emission by, 18: 16209
SHEETS
effects of pretreatment on adherence of ground-coat porcelain enamel and surface roughness of metal, 18: 16457(T) (AI-Trans-41)
SHELLS
blast effects on reactor containment vessel models, internal, 18: 17258 (BRL-Memo-1530)
contours for toroidal, method for determining meridional, 18: 16164 (ERR-AN-174)
SHELTERS
water supply production from wastes, evaluation of processes for, 18: 16228 (NP-13740)
SHIELDED CONTAINERS
design and construction of lead, 18: 16227 (NP-13691)
design with safety latch, 18: 16274(P)
hazards evaluation of shipping cask for irradiated PM-1 and PM-3A cores, 18: 16225 (MND-M-1856)
SHIELDING
effectiveness in space vehicles, gamma attenuation measurements of, 18: 16231 (TID-7689(p.76-80))
principles and uses, 18: 17375
SHOCK WAVES
electron density and continuum radiation behind, 18: 16648 (NP-13739)
formation in magnetogasdynamic flow, 18: 16560
microwave attenuation by, at Mach 8 to 12, time dependence of attenuation curve for, 18: 16565
production by directed explosions and mechanical impact, 18: 17372(T) (UCRL-Trans-992(L))
reflection of electromagnetically driven, properties of plasmas produced by, 18: 17137
SILICON
analysis for boron, neutron-reaction, 18: 15993
analysis for sodium by gamma spectrometry, 18: 15981
effects on Zircaloy-2 corrosion and hydrogen pickup in steam and water, 18: 16440 (WAPD-283)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron reactions (n,α) at 13.6 to 15 Mev, cross sections for, 18: 16971
preparation for radiation damage studies, 18: 16528 (SC-DC-64-346)
radiation damage and annealing in crystalline, Hall effect measurements of, 18: 16534
radiation damage in uniform avalanche diodes of, neutron, 18: 16528 (SC-DC-64-346)
use as surface barrier detector with guard ring, 18: 16314
x-ray scattering by single crystals of, diffuse bands in, 18: 16551 (TID-20364)

SILICON CARBIDES
melting temperature, evaluation for space technology, 18: 16521
radiation effects on luminescence of, gamma and neutron, 18: 16122
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
B_4C–SiC, corrosion by water at 680°C, 18: 16427 (WAPD-244)
B_4C–SiC, fabrication, 18: 16427 (WAPD-244)
SILICON IONS
spectral line intensities of lithium-like, 18: 17185
SILICON ISOTOPES Si-28
alpha inelastic scattering by, angular correlations in, 18: 16928 (ANL-6848(p.153-8))
deuteron reactions (d,p) with, distributions from polarized, 18: 16617
deuteron scattering by, angular distributions from, 18: 17021
neutron reactions at 12.5 to 21 Mev, cross sections for, 18: 16970
proton inelastic scattering by, excited states from, 18: 17042
SILICON ISOTOPES Si-29
deuteron reactions (d,p) with, proton polarization from, 18: 16994
neutron reactions (n,α) with, nuclear properties from, 18: 16995
proton reactions (p,γ) at 1.4 Mev, gamma transitions in, 18: 17059
SILICON ISOTOPES Si-30
proton reactions (p,γ) at 1.00 to 1.53 Mev, angular correlations for, 18: 17080
SILICON ISOTOPES Si-32
production in iron by 730 Mev protons, cross sections for, 18: 17049
SILICON OXIDES
analysis for sodium by gamma spectrometry, 18: 15981
melting temperature, evaluation for space technology, 18: 16521
radiation effects on sorptive properties of, electron-beam, 18: 16117
sorptive properties of colloidal, for fission products, 18: 16144
thermal conductivity of foams of, for use above 3000°F, 18: 16520
Al_2O_3–SiO_2, electric properties, 18: 17370(T) (SC-T-64-44)
SILICON SYSTEMS
Al–Si, effects of thermal cycling on stability of, 18: 16492
Pu–Si, phase studies, 18: 17351(R) (BMI-1659(Del.))
SILICONE RUBBERS
diffusion of radon and tritium through films of, 18: 16550 (TID-7688 (p.64-7))
SILTS
content in rivers and streams, x-ray attenuation gage for measuring, 18: 16195 (TID-7689(p.142))
radioactivity of, from Mediterranean Sea, 1960 to 1963, 18: 15759(R) (TID-20366)
rhodium-106 and ruthenium-106 migration and fixation in, 18: 17345
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
SILVER
argon ion large-angle scattering, 18: 16667
determination in chromium oxide-silver oxide, intensity ratio technique for x-ray spectrometric, 18: 15972
electron reactions with foils of, light emission in, 18: 16649 (ORNL-3485)
neon-20 reactions in emulsion with, models for, 18: 17010
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
radiation effects on, at low temperatures, saturation phenomena in defect production by neutron, 18: 16531(T) (Al-Trans-38)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
SILVER CHLORIDES
electric conductivity of thin film in aqueous silver electrolytes, 18: 16005(R) (TID-20354)
morphology of interface between liquid and solid, 18: 16005(R) (TID-20354)
reduction by niobium in fused halides, 18: 16032
SILVER ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
SILVER ISOTOPES Ag-104
hyperfine structure in iron and nickel, 18: 16954 (UCRL-11143)
SILVER ISOTOPES Ag-108
magnetic moment and spin of, measurement of, 18: 17068
SILVER ISOTOPES Ag-109
proton reactions with, nucleon cascades from, 18: 16974
SILVER ISOTOPES Ag-110
decay, 18: 17051
decay and hyperfine structure in iron and nickel, 18: 16954 (UCRL-11143)
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
separation from fission products by amalgam exchange, radiochemical, 18: 16148
SILVER ISOTOPES Ag-111
beta decay of, angular correlations in, 18: 17018
SILVER OXIDES
Cr_2O_3–Ag_2O, intensity ratio technique for x-ray spectrometric analysis for chromium and silver in, 18: 15972
SINGLE CRYSTALS
x-ray scattering by, broad diffuse bands from electron-lattice resonance in, 18: 16551 (TID-20364)
SKIN
radiation effects on sensitivity of, in guinea pigs, 18: 15825
radiation effects on mouse, of heavy charged particles, 18: 15827
SLURRIES
injection of radioactive, in cement, 18: 17346
SODIUM
corrosive effects of liquid, on plutonium nitride, 18: 17351(R) (BMI-1659(Del.))
determination in silicon and silicon oxides by gamma spectrometry, 18: 15981
effects on nitrogen-14 hyperfine coupling constants in EPR spectra of chloronitrobenzene, 18: 16068
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
monitoring in reactor coolants, engineering drawings of system for, 18: 16288
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
neutron total cross sections at 2 to 10 Mev, 18: 16973
radiation effects on content of, in rat serum and urine, x, 18: 15842
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
uptake by eye lenses with radioinduced cataracts, 18: 15816(T) (CEA-tr-R-1635)
vapor pressure of, correspondence with cesium, mercury, potassium, and rubidium, 18: 16035
SODIUM ALLOYS
K–Na, effects of impurities on operation of heat transfer system of, 18: 17310
K–Na, heat transfer to copper pipes, 18: 16173 (NP-13656)
SODIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KBr–NaBr, solvent properties for niobium, 18: 16032
SODIUM BRONZE
Na–W, heat capacity and thermodynamics at 15 to 300°K, 18: 16030
SODIUM CARBONATES
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
SODIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
diffusion in glycerol at 32°C, tracer study of, 18: 15998 (TID-7688 (p.52-63))
radiation effects on, low-temperature x, 18: 16106
radiolysis of, mechanism of gamma, 18: 16119
solvent properties of aqueous solutions of, for radium and uranium, 18: 16133
$CaCl_2$–NaCl, solvent properties for niobium, 18: 16032
KCl–NaCl, solvent properties for niobium, 18: 16032
$MgCl_2$–NaCl, solvent properties for niobium, 18: 16032
NaCl–K_2NbF_7–ZrF_4, production of niobium–zirconium alloys by electrolysis of, 18: 16431
SODIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
KF–NaF–ZrF_4, phase diagram of, liquidus surface in, 18: 16008(T) (ORNL-tr-31)

SODIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
SODIUM IONS
radiation effects on human erythrocytes flux of, x, 18: 15873
van der Waals radii of, relation of hydration energy to, 18: 16016
SODIUM ISOTOPES Na-22
decay of, positron polarization in, 18: 16552(R) (UCRL-11132)
energy levels of, from magnesium-24 (d,α) and sodium-23 (He^3,α) reactions, 18: 17055
energy levels of, $(d_{5/2})^2$ and $(f_{7/2})^2$, 18: 16933 (ANL-6848(p.182-7))
SODIUM ISOTOPES Na-23
energy levels and gamma spectra of, 18: 17001
helium-3 reactions (He^3,α), sodium-22 energy levels from, 18: 17055
neutron reactions with, cross sections at 13 to 21 Mev, 18: 16969
neutron reactions (n,α) at 14 Mev, 18: 17057
neutron reactions (n,γ), cross sections for, 18: 16947 (NP-13661)
nuclear magnetic resonance spectra in sodium bromide, chloride, and iodide, gradient-elastic tensor from quadrupole broadening in, 18: 16562
proton inelastic scattering by, excited states from, 18: 17071
SODIUM ISOTOPES Na-24
preparation and properties of, for use as neutron sources, 18: 16379
SODIUM NITRITES
spectra of gamma-irradiated single-crystal, infrared absorption, 18: 16100
SOILS
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
calcium, cesium-137, and strontium-90 sorption by ploughed, 18: 16217
cesium-137 and strontium-90 uptake by wheat from contaminated, 18: 15761
cesium-137 and strontium-90 movement in, contamination of food chains in, 18: 16239
fission product uptake by plants from, 18: 15735(R) (ARCRL-10)
herbicide distribution in, 18: 15735(R) (ARCRL-10)
moisture content prediction for top layer of, for induced activity prediction system, 18: 16206 (USNRDL-TR-662)
radioactive sludge injection into, methods for, 18: 17346
radioisotope ion exchange in, 18: 17342
radioisotope migration and retention in, conference on, 18: 17336
radioisotope movement in, geologic and hydrologic studies on, 18: 16207
radioisotope movement in, method for study of, 18: 16216
radioisotope movement in, physico chemical reactions of, 18: 16208
radioisotope movement in, Belgian studies on, 18: 17341
radioisotope permeability and retention in, device for measuring, 18: 16215
radiosterilization, 18: 15885
radiosterilized, growth of microorganisms in, 18: 15885
rhodium-106 and ruthenium-106 migration and fixation in, 18: 17345
rubidium-86 absorption and diffusion in, 18: 16199
strontium-90 content of, in German Democratic Republic, 1962, 18: 15909
temperature of, effects of neutron meter access tubes on, 18: 16201
SOLAR BATTERIES
development and testing of thermionic, 18: 16744(R) (TRW-ER-5802)
SOLAR FLARES
effects on Arctic communications, 18: 16841
effects on geomagnetic and ionospheric conditions, 18: 16842
effects on ionospheric radio communications, 18: 16823
effects on ionospheric D- and E-regions, 18: 16832
effects on ionospheric radio wave propagation, 18: 16844
effects on radio communications, conference on, 18: 16822
effects on radio wave absorption in ionospheric D-region, 18: 16834
effects on radio wave propagation at oblique incidence, 18: 16840
effects on radiowave absorption in ionosphere, polar blackouts in, 18: 16826
effects on transarctic h-f radio wave propagation, 18: 16831
effects on vhf radio wave ionospheric propagation at low latitudes, 18: 16839
effects on vlf radio wave propagation in ionosphere, 18: 16830
emission of particles and x rays by, measurement and theory, 18: 16641
ionospheric effects in F2 region, 18: 16643
ionospheric effects, 18: 16644
ionospheric effects of, 18: 16733
observation of solar type radio burst from flare star, 18: 16638
spectra of x rays from, 18: 16645
SOLAR RADIATION
detection and measurement of x, below 20 Å, 18: 16640
effects of polar cap absorption from, on 12-Mc radio wave propagation in ionosphere, 18: 16827
effects of proton, on D layer of ionosphere, 18: 16642
effects on arctic h-f propagation, 18: 16825
emission of x, during flare and quiet periods, 18: 16645
emission of x, measurement and theory, 18: 16641
interactions with magnetosphere, 18: 16629 (AD-430410)
ionospheric effects of gamma and x, 18: 16848
ionospheric effects of sunspots, 1953 to 1960, 18: 16851
rocket research program of U.S. IGY-IGC, third compilation, 18: 16580
SOLENOIDS
construction of superconducting, at Brookhaven, 18: 16603 (BNL-7534 (p.448))
SOLID PROPELLANTS
electric power production using, MHD systems for, 18: 16743 (MHD-646)
SOLIDS
book: *Radiation Effects on Solids*, 18: 16539
charged particle energy losses in, 18: 16688
charged particles energy losses in, 18: 16544
Cherenkov emission from, shock-initiated, 18: 16767
Cherenkov emission from, shock-initiated, 18: 16768
luminescence in, review of, 18: 16577
models for heterogeneous, 18: 16647 (KAPL-M-CHR-7)
radiation effects on diffusion in, 18: 16543
reactions with gases in fluidized beds, hydrodynamics of, 18: 16135
SOLVENT EXTRACTION PROCESSES
development for processing irradiated fuels, technical progress review on, 18: 16152
equipment for fast liquid-liquid, 18: 16146
for separating group IVA, VA, and rare earth elements, 18: 16157(P)
radiation effects, 18: 16143
SOLVENTS
radiation effects on, in extraction processes, 18: 16143
SOUND GENERATORS
radioisotope-powered, development of underwater, 18: 16397 (TID-7689(p.72-6))
SPACE
cosmic radiation hazards in, 18: 16735
electrodynamics in, cosmic, 18: 17122(T) (NASA-TT-F-175)
research on, 18: 16730(T) (FTD-TT-64-90)
SPACE VEHICLES
ceramic coatings for use in, flame-sprayed, 18: 16521
instrumentation of, redundant pulse-height discriminator for, 18: 16284
shielding effectiveness of, gamma attenuation measurements of, 18: 16231 (TID-7689(p.76-80))
use of alpha sources in low-thrust, 18: 17324
vibrations in flight, system for analysis of, 18: 16280 (SC-TM-328-62(72))
SPAIN
radiation dosimetry practices in, 18: 16268
SPARK DETECTORS
development of corona discharge, for thermal neutrons, 18: 16328
operation in magnetic fields, 18: 16327
performance of argon-filled, 18: 16337
use for detecting sub-nuclear particles in the ZGS, 18: 16326
SPECTRA
analysis of helium star, 18: 16630
Doppler shift of, method for detecting, 18: 16343
line broadening in, determination of charged particle concentration in low pressure discharge by, 18: 16659(T)
properties of nebular recombination, 18: 16631
properties of nebular recombination, 18: 16632
properties of nebular recombination, 18: 16633
theory of coronal, proton excitation lines in, 18: 16635
SPECTROMETERS
calibration of multichannel, method for, 18: 16331
design of vacuum-grating, for electron probe microanalysis of light elements, 18: 15986
SPECTROPHOTOMETERS

design of atomic absorption, 18: 16281
SPERM
radiation effects on production of, in dogs, x, 18: 15892
SPINELS
thermal conductivity of, for use above 3000°F, 18: 16520
SPLEEN
effects of nitrogen mustard on morphology and physiology of rat, 18: 15822
radiation effects on morphology and physiology of rat, 18: 15822
radiation effects on rat, early, 18: 15863
radiation scanning of, using technetium-99m, 18: 15913 (TID-7689(p.1-11))
STACK DISPOSAL
diffusion of gaseous waste from stacks in Tokai-mura, Japan, 18: 16226 (NP-13687)
plume rise from stack, graphs for estimating, 18: 16235(T) (AEC-tr-6365)
STAINLESS STEEL
collapse characteristics of tubes of types 304 and 347, studies of instantaneous- and creep-, 18: 16159 (ORNL-3555)
collapse pressures of tubular, length-diameter relations of, 18: 16422(R) (CEND-204)
compatibility of type 316, with plutonium carbide–uranium carbide systems at 1500°F, 18: 16426(R) (UNC-5068)
corrosion by cesium at 1600°F, role of oxygen in, 18: 16447
corrosion by nitric acid, 18: 16152
corrosion in water-cooled reactors, problems of, 18: 16445
corrosion of type 304, by steam and water to 500°C, 18: 16442(T,R) (EURAEC-960)
desorption of actinides from, 18: 16376(R) (MLM-1157)
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
radiation effects on mechanical properties of Type 347, 18: 17351(R) (BMI-1659(Del.))
stability of, effects of thermal cycling on, 18: 16492
thermal cycling effects on welds of, 18: 16422(R) (CEND-204)
vibration of wires of type 321, effects of length on, 18: 16376(R) (MLM-1157)
STAINLESS STEEL (AUSTENITIC)
radiation effects on mechanical properties, 18: 16525 (NP-13657)
STANDARDS
recommendations of ICRU for evaluation methods for radiological equipment and materials, 18: 16279 (NP-13746)
specifications for fabrication of fuel elements for Plutonium Recycle Test Reactor Mark I-M, 18: 16452 (HW-79290)
specifications for fuel element fabrication for Plutonium Recycle Test Reactor, 18: 16453 (HW-79291)
STANFORD LINEAR ACCELERATOR
storage rings for, vertical instabilities in electron, 18: 16595 (BNL-7534(p.375-8))
STARK EFFECT
use for measuring electric field strength in plasma, 18: 17188
STARS
ages of clusters of, common origin determination of, 18: 16639
corona spectral lines of, proton excitation of, 18: 16635
element abundances in red giant, theory for, 18: 16634
emission sources for radio galaxies, theory of, 18: 16636
neutron production in, 18: 17055
observation of solar type radio burst from flare, 18: 16638
spectra of helium, analysis of, 18: 16630
STATISTICS
model for angular momentum conservation for abnormal rotation of hydroxyl radical split from water, 18: 16024
random number generation, method for, 18: 16411 (CERN-64-13(Vol.I)(p.173-6))
theory of relaxation in isolated spin systems, quantum, 18: 16046
uses in high-energy physics, 18: 16408 (CERN-64-13(Vol.I)(p.1-86))
STEAM
corrosive effects on Zircaloy-2, additive effects of nitrogen, oxygen, and silicon on, 18: 16440 (WAPD-283)
steam–water, heat transfer to, flowing in heated tube, 18: 16171 (EURAEC-929)
STEARIC ACID
separation from lauric and myristic acids by reversed-phase chromatography using polymerized cellulose, 18: 16145
STEEL
brittle fracture propagation in, running, 18: 16470(R) (EURAEC-913)
corrosion in water-cooled reactors, problems of, 18: 16445
corrosion of Creusot 1.2 MD07 boilerplate, by steam and water at 300°C, 18: 16442(T,R) (EURAEC-960)
ductile-brittle transition temperature determination, 18: 16470(R) (EURAEC-913)
hardening of, effects of alloying additions on, 18: 16509
mechanical properties of types 13C, 15A, 17C, 21A, 23A, 27A, and 37A, 18: 16458(T,R) (EURAEC-811)
mechanical properties of embrittled, quenched, and tempered, 18: 16485(T,R) (EURAEC-829)
properties of welded, 18: 16458(T,R) (EURAEC-811)
radiation effects on mechanical properties, 18: 16525 (NP-13657)
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
radiation effects on structural properties of, neutron, 18: 16527(R) (NRL-Memo-1393)
weld parameters of B-66 and TZM, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
welding of thick, 18: 16458(T,R) (EURAEC-811)
welding of thick, by submerged-arc techniques, 18: 16459(T,R) (EURAEC-962)
STELLARATORS
magnetic surfaces in Etude, effects of transverse magnetic fields on, 18: 17178
plasma particle losses in, 18: 17228
plasma production by magnetic pumping in, 18: 17156
STELLARATORS (C)
plasma temperature measurement in, Doppler method of, 18: 17170
STERILITY
radiation effects on mouse, x, 18: 15893
radioinduced in male dogs, x, 18: 15892
STEROIDS
calcium-47 distribution and kinetics in dogs as affected by, 18: 15795
fever-production by, 18: 15755
STILBENE
luminescence of, discrimination of alpha-, deuteron-, and proton-produced, 18: 16324
STOCHASTIC METHODS
use for analysis of heterogeneous material, 18: 16647 (KAPL-M-CHR-7)
STRANGE PARTICLES
production in meson (π^-)-nucleon interactions at 6.1 to 18.1 Bev/c, 18: 16776
STRESS ANALYSIS
inertial load on a plate under blast loading, 18: 17359 (SCL-TM-64-34)
STRONTIUM
determination in biological samples, soils, and waters, flame spectrophotometric, 18: 15957 (RT/PROT(63)-13)
determination of, uses of radioactive tracers in, 18: 15962 (TID-7689(p.81-5))
effects of injected, on mineralization of dentin in rat teeth, 18: 15792
heat of sublimation and vapor pressure of, 18: 16517
ion exchange in soils, 18: 17342
ionization of, Auger effect in, 18: 16698
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by reversed-phase chromatography on D2EHPA treated paper, 18: 16141
separation from calcium and magnesium by anion exchange, 18: 16132
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from other fission products by sorption on silica gel, 18: 16144
separation from Purex waste ruthenium extraction phase using D2EHPA, 18: 16377(R) (ORNL-TM-515)
separation using α-hydroxyisobutyric acid, chromatographic, 18: 16142
solvent partition in D2EHPA hydrochloric acid, 18: 16147
sorption by clay minerals, effects of aluminum and iron oxides on, 18: 17344
uptake by banana leaf disks, effects of light on, 18: 15798

uptake by brown trout, 18: 16243
STRONTIUM BROMIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
STRONTIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
STRONTIUM FLUORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
STRONTIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
STRONTIUM IONS
use for exchange in clay mineral studies, comparison with calcium and magnesium, 18: 16200
van der Waals radii of, relation of hydration energy to, 18: 16016
STRONTIUM ISOTOPES Sr-85
maximum permissible concentrations of, for occupational exposure, 18: 15907
metabolism in mice, effects of environmental temperature on, 18: 15770(R) (LAMS-3034(p.65-72))
uptake by metastatic bone tumors, differential, 18: 15932
STRONTIUM ISOTOPES Sr-89
content in foodstuffs in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
deposition in Japan, 1957 to 1961, 18: 16214
maximum permissible concentrations of, for occupational exposure, 18: 15907
monitoring in milk in Canada from fallout, 18: 16229 (NP-13760)
movement in soils, Belgian studies on, 18: 17341
STRONTIUM ISOTOPES Sr-90
content in foodstuffs in Great Britain, 1962, 18: 15735(R) (ARCRL-10)
content in plankton and cuttlefish bone from Mediterranean Sea, 1961 to 1963, 18: 15758(R) (TID-20347)
content in plankton from Mediterranean Sea, 1960 to 1963, 18: 15759(R) (TID-20366)
content in soil and plants of German Democratic Republic, 1962, 18: 15909
deposition in Japan, 1957 to 1961, 18: 16214
determination in rainwater, method for, 18: 15958 (SCPRI(S)-81)
maximum permissible concentrations of, for occupational exposure, 18: 15907
migration in soils, contamination of food chains in, 18: 16239
monitoring in milk in Canada from fallout, 18: 16229 (NP-13760)
movement in clay soils, physico chemical reactions in, 18: 16208
movement in soils, method for study of, 18: 16216
movement in soils, Belgian studies on, 18: 17341
ratio to calcium in milk and infants' bones, 18: 15796
removal from water, device for, 18: 16249
separation from fission products by amalgam exchange, radiochemical, 18: 16148
separation from low-activity waste by foam treatment, 18: 16129(R) (RAI-116)
sorption by calcite-phosphate columns, extrapolation formula for, 18: 17343
sorption by ploughed soils, 18: 16217
therapeutic use, applicator needle for, 18: 15912(R) (ACRH-20(p.25-36))
uptake by brown trout, 18: 16243
uptake by wheat from contaminated soil, 18: 15761
STRONTIUM SCANDATES
preparation and structure, 18: 16015
STRONTIUM TITANATES
electric conductivity of, 18: 16045
STYPHNIC ACID, LEAD SALTS
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026
SULFONE, ETHYL VINYL
radioinduced polymerization with β-cyanoethyl acrylate, 18: 17351(R) (BMI-1659(Del.))
SULFONE, ETHYL VINYL, POLYMERS
electric properties, 18: 17351(R) (BMI-1659(Del.))
SULFUR
activation for fast neutron flux measurement, 18: 16356
determination in algal polysaccharides, neutron activation, 18: 15965
determination in beer and paper, activation, 18: 15970
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
isotopic exchange reactions of, use of sulfur-35 for studying, 18: 15999 (TID-7689(p.93-5))
SULFUR COMPOUNDS
isotopic exchange reactions of, use of sulfur-35 for studying, 18: 15999 (TID-7689(p.93-5))
SULFUR FLUORIDES
effects of seeding by, on supersonic argon plasma stream, 18: 17176
SULFUR IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
SULFUR ISOTOPES S-32
neutron inelastic scattering by, distributions from, 18: 16972
proton inelastic scattering by, excited states from, 18: 17042
SULFUR ISOTOPES S-34
proton reaction (p,γ), angular distribution and spectra from, 18: 16945 (NP-13601)
SULFUR ISOTOPES S-35
exchange between elemental sulfur and sulfur-containing compounds, 18: 15999 (TID-7689(p.93-5))
production of, review of methods for, 18: 16398 (JAERI-4027)
SULFUR ISOTOPES S-37
preparation and properties of, for use as neutron sources, 18: 16379
SULFURIC ACID
determination in uranium solutions by potentiometric titration, 18: 15966
effects of concentration of, on uranium peroxide solubility, 18: 16012
SUN
ionospheric effects of eclipses of, in F2 region, 18: 16643
spot cycle effects on radio propagation, 18: 16843
SUPERCONDUCTIVITY
crystal structure effects on, 18: 16878(R) (SSD-TDR-63-98)
time effects on, 18: 16881
SUPERCONDUCTORS
critical current behavior in longitudinal and transverse fields, 18: 16883
critical fields in indium–lead, 18: 16884
design of magnet with inductive excitation, 18: 16880
energy gap in, effects of magnetic field on, 18: 16885
theory of, Hartree-Fock solution in, 18: 16814
use in accelerators and storage rings, 18: 16602 (BNL-7534(p.417-47))
use in gating devices, 18: 16290(P)
use in magnetic field shaping, 18: 16604 (BNL-7534(p.449-77))
wave amplification by films of, nonlinear reactance and frequency conversion at 1.8 to 2.2°K, 18: 16879
SURFACE WATERS
analysis for radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
flow rate studies, maximum allowable radiotracer injections for, 18: 15905 (TID-7689(p.34-7))
sediment concentration in, x-ray attenuation gage for measuring, 18: 16195 (TID-7689(p.142))
SURFACES
scanning with beam of charged particles, design of apparatus for, 18: 16628(P)
SURGERY
anterolateral cordotomy, technique for, 18: 15734(R) (ACRH-20(p.37-46))
on irradiated tissue, precautions for, 18: 15942
SUSPENSIONS
flow of gas-solid, 18: 16176 (NYO-2930-1)
SWIMMING POOL REACTORS
cooling system design for increased power in, 18: 17331(P)
SWITCHES
electron tube for high-power, development of deuterium-filled, 18: 16167
SYNCHROTRONS
beam deflector design for Adone, 18: 16610 (LNF-63/72)
betatron-injector synchronization with, 18: 16624
experimental programs for 1000-Bev and high-intensity 30-Bev, 18: 16584 (BNL-7534(p.39-48))
general alarm system of CERN, 18: 16605 (CERN-64-7)
nuclear stars in personnel photographic film detectors at CERN, 18: 16262

proton colliding-beam storage-ring developments for, 18: 16753 (BNL-7534(p.312-17))
space-charge effects on proton, intensity limitations from transverse, 18: 16593 (BNL-7534(p.324-67))
storage rings for CERN proton, 18: 16585 (BNL-7534(p.128-70))
storage rings for electron, development of "AdA" and "Adone", 18: 16586 (BNL-7534(p.171-208))
use of pulsed reactor as neutron-gas target source for, 18: 16600 (BNL-7534(p.406-13))
SYSTEMS FOR NUCLEAR AUXILIARY POWER
heat transfer, 18: 17322(R) (TID-19971)
SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-2)
power conversion system for, development of rotational speed control for, 18: 17319 (NAA-SR-6310)
SZILARD-CHALMERS REACTIONS
in ammonium, potassium, and tetramethyl ammonium dichromates, effects of thermal and uv annealing on, 18: 16115
in cyclohexane with and without iodide, free radical yields in, 18: 16112

T

TANTALUM
corrosion by cesium at 1600, 1800, and 2500°F, role of oxygen in, 18: 16447
creep and stress-rupture in argon and hydrogen at 2400 to 2600°C, 18: 16424(R) (GEMP-270A)
diffusion of krypton-85 in, at high temperatures, 18: 16424(R) (GEMP-270A)
photon scattering by, giant resonance effects on elastic, 18: 17040
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
separation by solvent extraction using butyl phosphates, 18: 16157(P)
TANTALUM ALLOYS
Cr–Ta, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Fe–Ta, pickling and cold rolling, 18: 17351(R) (BMI-1659(Del.))
Ta–W, weld parameters of, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
Ta–W–Zr, phase studies on, 18: 16503
TANTALUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
TANTALUM CARBIDES
melting temperature, evaluation for space technology, 18: 16521
preparation and properties of, 18: 16498
TANTALUM ISOTOPES Ta-176
energy levels and gamma spectra of, 18: 16983
TANTALUM ISOTOPES Ta-181
neutron reactions (n,α) at 14 Mev, alpha spectra from, 18: 17058
TANTALUM NITRIDES
preparation and properties of, 18: 16498
TANTALUM SYSTEMS
Nb–Ta, superconductivity of, time effects in, 18: 16881
TECHNETIUM
bibliography on, 18: 15947
chemical properties, 18: 15947
TECHNETIUM ALLOYS
Pd–Tc, structure, 18: 16489
Pt–Tc, structure, 18: 16489
Rh–Tc, structure, 18: 16489
TECHNETIUM COMPOUNDS
with rare earths, analysis for laves phase in $MgZn_2$-type, 18: 16505
TECHNETIUM ISOTOPES
half lives and decay schemes, 18: 15947
TECHNETIUM ISOTOPES Tc-99
properties and handling, 18: 15947
properties of 6-hr isomer for diagnostic uses, 18: 15913 (TID-7689(p.1-11))
TEETH
mineralization of dentin in rat, effects of injected fluoride, parathyroid extract, or strontium on, 18: 15792
radiation effects on, from radiotherapy for oral cancer, gamma and radium, 18: 15921
TELEMETERING SYSTEMS
airborne vibration analysis for, 18: 16280 (SC-TM-328-62(72))
ion engine exhaust effects on, 18: 16286
TELLURIUM
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
separation from antimony, radiochemical, 18: 16149
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
TELLURIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
TELLURIUM ISOTOPES Te-124
energy levels and gamma spectra of, 18: 17015
TELLURIUM ISOTOPES Te-125
energy levels of, parity and spin of, 18: 17047
TELLURIUM SYSTEMS
AsSeTe, radiation effects on electric conductivity of, 18: 16541
TEMPERATURE
effects of hypothermia on radiosensitivity of rats, 18: 15887
effects on electric conductivity, 18: 16660
TEMPERATURE CONTROL
equipment for gas-cooled reactor, design of electronic automatic, 18: 17308
TENNESSEE
cesium-137 and potassium-40 body burdens in Davidson Co. in, 18: 16232 (TID-18603)
TENSILE PROPERTIES
measurement of Young's modulus, method for, 18: 16186 (WADD-TR-61-72 (Vol.XXIII))
TERBIUM
hyperfine structure parameters, 18: 16516
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
thermal capacity at 0.05 to 0.9°K, 18: 16516
TERBIUM COMPLEXES
with dibenzoylmethide and TTA, luminescence decay of, 18: 16089
TERBIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505
TERBIUM ISOTOPES Tb-159
proton reactions (p,9n or 10n) with, excitation functions, 18: 16975
TERBIUM ISOTOPES Tb-161
decay of, electron spectra from, 18: 16325
TEREPHTHALIC ACID, ETHYLENE POLYMER ESTERS
diffusion of radon and tritium through Mylar films, 18: 16550 (TID-7688 (p.64-7))
TERPHENYL
properties for use as coolant in Orgel Reactor, 18: 17307
TEXAS
fallout monitoring at San Angelo by high-altitude balloon flights, July to September 1963, 18: 16203(R) (NYO-10496)
TEXTILES
decontamination by ultrasonics, 18: 16250
THALLIUM
additive effects on thermoluminescence of potassium chloride, 18: 16083
separation from fission products by amalgam exchange, radiochemical, 18: 16148
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
THALLIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
THALLIUM ISOTOPES Tl-204
separation from fission products by amalgam exchange, radiochemical, 18: 16148
THALLIUM SYSTEMS
AsSeTl, radiation effects on electric conductivity of, 18: 16541
THERMAL CONDUCTIVITY
in Lorentz-type gas of electrons and air molecules, 18: 17225

measurement using mercury contacts, method for, 18: 16533
THERMAL DIFFUSION
column performance analyses for, 18: 16376(R) (MLM-1157)
THERMAL INSULATION
design for hot and cool coolant tanks in sodium-graphite reactor, 18: 17273(P)
THERMAL REACTORS
physics of graphite-moderated, effects of moderator scattering law on, 18: 17266
THERMIONIC CELLS
collector electrode development for nuclear-, 18: 16742(R) (GA-4804)
development and testing of solar, 18: 16744(R) (TRW-ER-5802)
performance of, using fission product ionization, 18: 16740(R) (AD-425231)
THERMODYNAMICS
fugacity series in, cancellation of cluster integrals in, 18: 16572
of ionized gas, 18: 16662
triplet distribution functions for hard spheres, 18: 16568
THERMOLUMINESCENCE
method for personnel dosimetry, 18: 16361
THERMONUCLEAR REACTORS
design of Tokomak-III, 18: 17111 (NP-13696)
THICKNESS GAGES
design of alpha-particle, 18: 16383 (TID-7688(p.7-13))
design of beta-ray, 18: 16396(P)
THORIUM
determination in minerals and ores, spectral, 18: 15991
determination of, in uraninites, 18: 15990
effects on oxidation resistance of chromium, 18: 16423(R) (GEMP-197)
neutron total cross sections at 2 to 10 Mev, 18: 16973
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from fission products by solvent extraction using D2EHPA, 18: 16147
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
THORIUM ALLOYS
Mg–Th, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Pd–Th, phase studies on, 18: 16501
THORIUM CARBIDES
cubic transformation in divalent, 18: 16477 (ORNL-3588)
hydrolysis of irradiated, 18: 16152
ThC–UC, preparation, 18: 16049
THORIUM ISOTOPES Th-227
desorption from stainless steel, 18: 16376(R) (MLM-1157)
THORIUM ISOTOPES Th-232
helium ion fission of, energetics of, 18: 17067
proton reactions at 30 to 120 Mev with, actinium isotopes from, 18: 16976
THORIUM NITRIDES
thermal stability, 18: 16473 (HW-SA-3370)
THORIUM OXALATES
preparation of high-bulk-density, 18: 16063(P)
THORIUM OXIDES
thermal conductivity of foams of, for use above 3000°F, 18: 16520
THORIUM(IV) OXIDES
addition to fueled beryllia, effects on fuel lifetime, 18: 16424(R) (GEMP-270A)
electrodeposition on aluminum, procedure for, 18: 16460
melting temperature, evaluation for space technology, 18: 16521
preparation, 18: 16049
sublimation kinetics at 1600 to 2200°C, 18: 16486(T,R) (EURAEC-969)
ThO_2–UO_2–Y_2O_3, properties and reactions of internal conversion fuel compositions of, 18: 16424(R) (GEMP-270A)
THULIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
THULIUM COMPOUNDS
with technetium, analysis for laves phase in $MgZn_2$-type, 18: 16505
THULIUM ISOTOPES Tm-169
energy levels and gamma spectra of, 18: 16982
neutron reactions with, scattering widths for resonance, 18: 17034
THYMIDINE
effects on HeLa cell uridine uptake, 18: 15802
THYMUS
radiation effects on immunological restoration by, in rats, 18: 15869
THYROID DISEASES
diagnosis of, using technetium-99m, 18: 15913 (TID-7689(p.1-11))
radiotherapy using iodine-131, effects on parathyroid function in man, 18: 15926
THYROID GLAND
effects of removal of, on creatine excretion in x-irradiated rats, 18: 15876
iodine metabolism in, in adults and children, 18: 15775(R) (LAMS-3034 (p.187-200))
iodine metabolism in rat, effects of chlordiazepoxide on, 18: 15787
iodine metabolism in rat, effects of serotonin on, 18: 15789
iodine uptake by, in box turtles, method of whole-body counting, 18: 15781 (TID-7689(p.20-2))
iodine-131 uptake studies, equipment design for, 18: 15919
physiology of, in rats and mice, effects of chlordiazepoxide on, 18: 15788
THYROID HORMONES
carbon-14-labeled thyroxine, synthesis of, 18: 16074
effects on iodine-131 absorption by human gastrointestinal tract, 18: 15791
metabolism and secretion in children, 18: 15782 (TID-7689(p.22-5))
TIN
critical currents in superconducting films of, 18: 16889
determination in bismuth-tin alloys, intensity ratio technique for x-ray spectrometric, 18: 15972
determination in niobium-tin coated metal ribbon, intensity ratio technique for x ray spectrometric, 18: 15972
energy gap in superconducting films of, effects of magnetic field on, 18: 16885
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
separation by solvent extraction using butyl phosphates, 18: 16157(P)
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
vapor pressure at 1400 to 1590°K, 18: 16006 (UCRL-11124)
TIN ALLOYS
Bi–Sn, intensity ratio technique for x-ray spectrometric analysis for bismuth and tin in, 18: 15972
Bi–Sn, radiation effects on contact melting of, 18: 16538
Cd–Sn, radiation effects on contact melting of, 18: 16538
In–Sn, radiation effects on contact melting of, 18: 16538
Nb–Sn, intensity ratio technique for x-ray spectrometric analysis, 18: 15972
Nb–Sn, use in accelerators and storage rings as superconductors, 18: 16602 (BNL-7534(p.417-47))
Pb–Sn, effects of electric current on purification by solidification, 18: 16428(T) (AEC-tr-6366)
Pb–Sn, zone melting of, effects of electric current on segregation in, 18: 17367(T) (AEC-tr-6376)
TIN CHLORIDES
radioinduced chlorination of toluene by, chlorotoluene yields in, 18: 16094
TIN COMPOUNDS
preparation of organic, 18: 17351(R) (BMI-1659(Del.))
TIN ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
TIN ISOTOPES Sn-113
separation from fission products by amalgam exchange, radiochemical, 18: 16148
TIN ISOTOPES Sn-125
beta decay of, gamma-gamma angular correlations in, 18: 17047
preparation and properties of, for use as neutron sources, 18: 16379
TISSUE CULTURES
radiation effects on sarcoma cells in, deuteron, 18: 15829
radiation effects on enzyme activity in extracts from, 18: 15831
radiation effects on DNA synthesis in, effects of virus infection on, 18: 15835

radiation effects on subcellular responses in liver cells in, 18: 15864
TISSUES
cesium-137 content of animal, comparison with potassium, 18: 15783 (TID-7689(p.55-8))
microscopy of, lipid demonstration by fluorescent dyes in, 18: 17373(T) (UCRL-Trans-1033)
radiation dose absorbed by, film dosimeter determination of, 18: 16263
radiography of, methods of reducing radiation intensity in isotopic, 18: 15918 (TID-7689(p.29-30))
surgery on irradiated, precautions for, 18: 15942
TITANIUM
effects on corrosion resistance and mechanical properties of beryllium, 18: 16448(P)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by solvent extraction using butyl phosphates, 18: 16157(P)
TITANIUM ALLOYS
Be–Ti, corrosion resistance to carbon dioxide and mechanical properties, 18: 16448(P)
Nb–Ti, formation and aging characteristics of α-martensitic phase in quenched, 18: 16508
TITANIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
TITANIUM CARBIDES
bonding and vacancies in, 18: 16483(T) (AEC-tr-6374)
melting temperature, evaluation for space technology, 18: 16521
preparation and properties of, 18: 16498
TITANIUM ISOTOPES
proton reactions (p,t) with, $T = T_z + 2$ states from, 18: 16923 (ANL-6848(p.125-9))
TITANIUM ISOTOPES Ti-44
production in iron by 730 Mev protons, cross sections for, 18: 17049
TITANIUM ISOTOPES Ti-46
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
TITANIUM ISOTOPES Ti-47
deuteron reactions (d,p) at 6 Mev, 18: 16915 (ANL-6848(p.79-85))
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
TITANIUM ISOTOPES Ti-48
alpha scattering at 28.5 Mev, nuclear states from, 18: 17046
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
energy levels of, low-lying, 18: 16915 (ANL-6848(p.79-85))
proton inelastic scattering by, excited states from, 18: 17071
proton inelastic scattering by, selection rules in, 18: 16930 (ANL-6848(p.168-71))
TITANIUM ISOTOPES Ti-49
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
TITANIUM ISOTOPES Ti-50
deuteron reactions (d,He^3) with, 18: 16931 (ANL-6848(p.177))
TITANIUM NITRIDES
preparation and properties of, 18: 16498
thermal stability, 18: 16473 (HW-SA-3370)
TITANIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
TITANIUM SYSTEMS
H–Ti, magnetic susceptibility at 600 to 900°C, 18: 16502
TOLUENE
oxidation of mixture with α,α,α-trideuteriotoluene by chromyl chloride, deuterium isotope effects in, 18: 16072
radioinduced chlorination by stannic chloride, chlorotoluene yields in, 18: 16094
TOLUENE, CHLORO-
yields in radioinduced chlorination of toluene by stannic chloride, 18: 16094
TOLUENE, TRINITRO-
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026
TOXINS
radiation effects on response of mice to, 18: 15856
TRACER TECHNIQUES
self-diffusion of hydrogen in mixtures, 18: 16054
use for measuring filter efficiency for removal of oil mist from compressed air, 18: 16388 (TID-7688(p.78-80))
use in study of vacuum distillation and thin film deposition, 18: 16386 (TID-7688(p.40-3))
use in studying impurity problems in semiconductors, 18: 16385 (TID-7688(p.38-40))
uses in determining surface self-diffusion of adsorbed ions, 18: 16479 (TID-7689(p.86-9))
TRACER TECHNIQUES (AGRICULTURE)
for evaluation of effects of an insecticide on forest ecosystem, 18: 17362(R) (TID-20355)
TRACER TECHNIQUES (BIOLOGY)
computer programs for data analysis, FORTRAN for IBM-7090, 18: 15737(R) (LAMS-3034(p.168-79))
development, 18: 15756
equipment design for iodine-131, 18: 15919
uses in studies of marine biosphere, 18: 15748 (TID-7689(p.69-72))
TRACER TECHNIQUES (BOTANY)
landscape investigations using cesium-137, 18: 15762
TRACER TECHNIQUES (CHEMICAL ENGINEERING)
use for detecting leaks in heat exchangers in petroleum refinery, 18: 16389 (TID-7688(p.80-3))
use in studying catalyst flow distribution in seal leg in petroleum cracking plant, 18: 16390 (TID-7688(p.84-90))
use of xenon-133 for measuring process gas flow rates, 18: 16387 (TID-7688(p.76-8))
TRACER TECHNIQUES (CHEMISTRY)
use in study of adsorption of trimethylstearylammonium bromide on HMX, 18: 16384 (TID-7688(p.31-7))
use in study of diffusion of sodium chloride in glycerol at 32°C, 18: 15998 (TID-7688(p.52-63))
uses for frequency response testing of aqueous mixing systems, 18: 16001 (TID-7689(p.126-8))
uses in alkaline earth determinations, 18: 15962 (TID-7689(p.81-5))
uses in measuring acid circulation, volume, replacement, and entrainment in alkylation plant, 18: 16067 (TID-7689(p.128-33))
uses in studies of thin film deposition from ring and linear vapor sources, 18: 16000 (TID-7689(p.96-103))
TRACER TECHNIQUES (ENGINEERING)
calibration for measuring stream flow rates, 18: 16391 (TID-7688(p.91-4))
development for wear measurement of machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))
use of krypton-85 for leak detection in Saturn rocket, 18: 16392 (TID-7688(p.95-7))
TRACER TECHNIQUES (GEOLOGY)
methods using fluid tracers for oil well studies, 18: 16192 (TID-7689 (p.38-45))
radioisotope maximum allowable concentrations in streams for flowrate studies, 18: 15905 (TID-7689(p.34-7))
use of radioactive sand in fracturing studies, 18: 16194 (TID-7689 (p.105-18))
TRACER TECHNIQUES (MEDICINE)
direct counting of iron-55 and iron-59 in mixtures, 18: 15980
double tracer method using nanocurie doses of iodine-125 and iodine-131 for studies of iodine metabolism, 18: 15775(R) (LAMS-3034(p.187-200))
for gamma cardiography, using iodine-131- or iodine-132-labeled albumin as tracer, 18: 15925
for studies of gastrointestinal tract function, 18: 15934
radioisotope encephalography, evaluation for diagnosis of brain tumors, 18: 15937
uses in determining permeability characteristics of pulmonary membrane, 18: 15747 (TID-7689(p.52-4))
uses of sulfur-35-labeled drugs for blood brain barrier changes, 18: 15746 (TID-7689(p.50-1))
TRACER TECHNIQUES (METALLURGY)
use of tritium in studying defect structures in aluminum, 18: 16478 (TID-7688(p.44-9))
uses for determination of sources of ceramic inclusions in cast gas turbine components, 18: 16456 (TID-7689(p.119-25))
TRACER TECHNIQUES (MINERALOGY)
uses in estimation of *cec* of siliceous sediments, 18: 16193 (TID-7689 (p.85-6))

TRANSISTORS
properties and uses of unipolar field-effect, 18: 16282
TRANSURANIC ELEMENTS
chemistry, compounds, handling, and radiation hazards of, review of, 18: 16051
TRAUMA
fistula development after surgery and irradiation of uterine carcinomas, 18: 15839
radiation effects on cat, x, 18: 15818(T) (JPRS-23544)
TREES
mineral transfer by root systems of, tracer studies of, 18: 15757 (TID-7689(p.62-5))
s-TRIAZINE, HEXAHYDROTRINITRO-
meson (π^-) capture by, thermal initiation theory of spherical hot spots from, 18: 16026
TRITIUM
counting in water, equipment and method for, 18: 15978
counting of, preparation of methane from water for, 18: 16075
determination in biological materials by flask combustion, method for, 18: 15973
determination on chromatograms, evaluation of techniques for, 18: 15984
deuteron reactions (d,n) at 21 Mev, 18: 16951(R) (TID-20311)
diffusion from alpha- and gamma-iron meteorites, 18: 16210
diffusion through films of plastics, rubbers, and rubber vulcanizates, 18: 16550 (TID-7688(p.64-7))
incorporation in steroid estrogens, 18: 16078 (TID-7689(p.46-50))
labeling of linoleic acid using, method for, 18: 16070
migration and retention in lithosphere at NRTS, Idaho, 18: 17349
production of plasma of, device for, 18: 17242(P)
proton reactions (p,n) at 1.9 to 3.5 Mev, neutron polarization in, 18: 17052
radioautography using, beta self-absorption in, 18: 15928
tracer use in studying defect structures in aluminum, 18: 16478 (TID-7688(p.44-9))
uptake by thymidine, effects on HeLa cells, 18: 15802
TRITONS
magnetic moment of, meson-exchange contribution to, 18: 17074
properties of, book on, 18: 17097
reactions (t,d) with carbon-12 at 12 Mev, 18: 16914 (ANL-6848(p.70-8))
reactions (t,d) with magnesium-26, 18: 16918 (ANL-6848(p.104-5))
reactions (t,n) with oxygen-16, fluorine-19 preparation in, 18: 16111
TROPIC ACID
carbon-14-labeled, synthesis of, 18: 16069
TROPINE
carbon-14-labeled, synthesis of, 18: 16069
TRYPTOPHAN
derivation from higher plants of d-, 18: 17366(T) (AEC-tr-6363)
TUBERCULOSIS
radiation effects on, altitude dependence of cosmic, 18: 15882
radiation effects on tubercle bacilli virulence, cosmic, 18: 15884
radiation effects on Japanese mortality from, from atomic bomb, 18: 15875
radioinduced immunizing property of tubercle bacilli cosmic, 18: 15883
vaccine against, preparation using gamma-irradiated bacteria, 18: 15824
TUBES
coating aluminum, with thorium dioxide by electrodeposition, 18: 16460
collapse characteristics of stainless steel, studies of instantaneous- and creep-, 18: 16159 (ORNL-3555)
critical heat fluxes and pressure drops in steam–water mixtures flowing in vertical, 18: 16172 (EURAEC-951)
heat transfer in steam–water mixtures flowing in heated, 18: 16171 (EURAEC-929)
heat transfer in transverse flow around bundles of, 18: 16175 (NP-13712)
TUMORS
diagnosis of gastrointestinal, by localization of incorporated phosphorus-32 using miniature Geiger counter on gastroscope probe, 18: 15929
radiation effects on virus-producing cells of sarcoma, detection methods for, x, 18: 15838
radiation effects on Japanese mortality from, from atomic bomb, 18: 15875
radiosensitivity and growth of Walkers's, in hibernating rats, 18: 15878
radiotherapy of oral, development of osteomyelitis of jaws after, 18: 15860
radiotherapy of thoracic, chest lesions induced by, 18: 15888
TUNGSTATES
analysis of alkali metal, chemical, 18: 15952 (IS-800)
TUNGSTEN
atomic field of, eigenfunctions for, 18: 16658
corrosion by cesium at 1600, 1800, and 2500°F, role of oxygen in, 18: 16447
creep and stress-rupture at 1600 to 2800°C, 18: 16424(R) (GEMP-270A)
determination in alkali metal tungsten bronzes and other compounds, 18: 15952 (IS-800)
determination in rhenium-tungsten alloys, intensity ratio technique for x ray spectrometric, 18: 15972
effects on boron carbide–uranium dioxide reactions to 2200°C, 18: 16468(R) (CEND-203)
electronic work function of cesium-coated, 18: 16742(R) (GA-4804)
fracture behavior of, effects of heat treatments on, 18: 16475 (NP-13755)
hardness at 2000 to 2700°C, 18: 16519(T)
ionization of hot, limits of detection of weak alkali molecular beams by, 18: 16555 (UCRL-Trans-1031)
properties of sheet of, research program on, 18: 16476(R) (NP-13759)
proton elastic scattering at 17 Mev, optical model analysis of, 18: 16920 (ANL-6848(p.114-17))
radiation effects on electric and mechanical properties of rod and sheet, 18: 16424(R) (GEMP-270A)
tensile properties at 1370 to 2980°C *in vacuo*, 18: 16504
weld parameters of, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
x-ray emission at 300 to 1100°K, interference maxima of, 18: 16687
TUNGSTEN ALLOYS
Cr–W, preparation, fabrication, mechanical properties, and oxidation resistance, 18: 16423(R) (GEMP-197)
Mo–Re–W, mechanical properties of, effects of composition on, 18: 16424(R) (GEMP-270A)
Nb–W–Zr, phase studies on, 18: 16494
Re–W, creep and stress-rupture at 2200 to 2600°C, 18: 16424(R) (GEMP-270A)
Re–W, intensity ratio technique for x-ray spectrometric analysis for rhenium and tungsten in, 18: 15972
Re–W, radiation effects on electric and mechanical properties of, 18: 16424(R) (GEMP-270A)
Ta–W, weld parameters of, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
Ta–W–Zr, phase studies on, 18: 16503
TUNGSTEN BRONZE
analysis of alkali metal, chemical, 18: 15952 (IS-800)
Na–W, heat capacity and thermodynamics at 15 to 300°K, 18: 16030
TUNGSTEN CARBIDES
melting temperature, evaluation for space technology, 18: 16521
TUNGSTEN ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
TUNGSTEN ISOTOPES W-176
decay scheme, 18: 16983
TUNGSTEN ISOTOPES W-182
deuteron reactions (d,p) at 12 Mev, 18: 16916 (ANL-6848(p.86-97))
neutron reactions with, radiation widths for resonance, 18: 17033
TUNGSTEN ISOTOPES W-183
energy levels of, model for lower, 18: 16916 (ANL-6848(p.86-97))
neutron reactions with, radiation widths for resonance, 18: 17033
TUNGSTEN ISOTOPES W-184
deuteron reactions (d,p) at 12 Mev, 18: 16916 (ANL-6848(p.86-97))
TUNGSTEN ISOTOPES W-185
energy levels of, model for lower, 18: 16916 (ANL-6848(p.86-97))
TUNGSTEN ISOTOPES W-186
deuteron reactions (d,p) at 12 Mev, 18: 16916 (ANL-6848(p.86-97))
neutron reactions with, radiation widths for resonance, 18: 17033
TUNGSTEN ISOTOPES W-187
energy levels of, model for lower, 18: 16916 (ANL-6848(p.86-97))
TUNGSTEN OXIDES
analysis of, chemical, 18: 15952 (IS-800)
TUNGSTEN SYSTEMS
W–UN, preparation, 18: 17351(R) (BMI-1659(Del.))
W–UO_2, preparation, 18: 17351(R) (BMI-1659(Del.))
TURBINE BLADES

casting of, tracer studies of source of ceramic inclusions in, 18: 16456 (TID-7689(p.119-25))
TURTLES
iodine uptake and thyroid and whole-body retention by box, tracer studies of, 18: 15781 (TID-7689(p.20-2))

U

ULTRASONICS
use in decontamination of glass, metals, plastics, and textiles, 18: 16250
ULTRAVIOLET RADIATION
annealing effects on neutron irradiated ammonium and potassium dichromates, 18: 16114
annealing effects on Szilard-Chalmers reactions in ammonium, potassium, and tetramethyl ammonium dichromates, 18: 16115
effects on bacteriophage desoxyribonucleic acid, 18: 15832
effects on color of methylene blue in glycerol or water, 18: 16081
effects on etching of quartz, hypothesis for, 18: 16535
effects on thermoluminescence of potassium chloride crystals, 18: 16083
sensitivity in *E. coli*, 18: 15844
transmutation efficiency in Saccharomyces, 18: 15870
UNDERGROUND EXPLOSIONS
seismic data for CLEARWATER event, long-range, 18: 16189 (AD-427125(Rev.))
seismic data for SHOAL event, local, 18: 16190 (NP-13757)
seismic data from STONES event, long-range, 18: 16191 (NP-13586(Rev.))
seismic wave detection on ocean bottom, 18: 16198
seismic wave propagation from Hardhat, surface, 18: 16197
use in excavations, 18: 16162 (UCRL-7657)
use to construct sea-level transisthmian canal, 18: 16161 (SC-4929(RR))
URANINITES
age of, direct lead-206/lead-207 ratio determination, 18: 16218
analysis for thorium, 18: 15990
URANIUM
analysis for traces of cadmium and rare earths, spectrographic, 18: 15950 (EUR-587.e)
book: *Principal Characteristics of Uranium Geochemistry*, 18: 16221
detection of dusts of, in air, alpha monitor for, 18: 16298 (K-1589)
determination in kerosene–TBP solutions by potentiometric titration, 18: 15966
determination in uranium solutions by potentiometric titration, 18: 15966
fabrication by casting, grain refinement by addition of shot during, 18: 16454 (NMI-7019)
grain-size of, effects of alloying additions on, 18: 16509
ionization by electron impact, 18: 16088
metallography, 18: 16466 (BMI-1664)
microstructure, 18: 16466 (BMI-1664)
neutron absorption by, transport theory calculations of thermal utilization in, 18: 16955 (ZFK-TPH-1)
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
neutron emission by, 18: 16209
neutron resonance integrals for, 18: 16895 (NP-13662)
neutron total cross sections at 2 to 10 Mev, 18: 16973
preparation by bomb reduction of uranium tetrafluoride, 18: 16049
proton fission at 156 Mev, cross sections and distributions from, 18: 17004
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from clay by leaching using aqueous solutions of calcium chloride or sodium carbonate, 18: 16133
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from irradiated fuel elements by solvent extraction, radiation effects on, 18: 16143
solubility in calcium-zinc alloys, 18: 16153
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
spectra in nitrate-perchlorate media, 18: 16029
stability of, effects of thermal cycling on, 18: 16492
tensile properties, 18: 16466 (BMI-1664)
URANIUM ALLOYS
fluorination of, for separation from irradiated reactor fuels, 18: 16153
Be–U, preparation, 18: 16049
fissium–U, melt refining, 18: 16153
Mo–Pu–U, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, fabrication and properties for use as fuel element in Rapsodie, 18: 17290(T) (AEC-tr-6359)
Mo–Pu–U, radiation stability, 18: 17290(T) (AEC-tr-6359)
Mo–U, corrosion by water at 650°F, alloying effects of platinum on, 18: 16449(P)
Pu–U, phase diagrams of, 18: 16493
U–Zr, chlorination of irradiated, in reprocessing, 18: 16153
U–Zr, dissolution of Zircaloy-clad, using hydrofluoric acid, 18: 16152
U–Zr, properties as reactor fission rate detector, 18: 17278 (KAPL-M-6101)
URANIUM BORIDES
dissociation of UB_4, 18: 16468(R) (CEND-203)
URANIUM CARBIDES
burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
coating particles of, development of methods for, 18: 16049
diffusion of carbon in, 18: 17351(R) (BMI-1659(Del.))
diffusion of fission products from, effects of surface area on, 18: 17351(R) (BMI-1659(Del.))
diffusion of xenon from single crystals, 18: 16486(T,R) (EURAEC-969)
hydrolysis of irradiated, 18: 16152
preparation of, development of methods for, 18: 16049
properties and impurities of powdered, 18: 17351(R) (BMI-1659(Del.))
PuC–UC, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
PuC–UC, compatibility with niobium, niobium–zirconium alloy, type 316 stainless steel, and Zircaloy-2 at 1100 and 1500°F, 18: 16426(R) (UNC-5068)
PuC–UC, crystal structure and phase studies, effects of aging on, 18: 16426(R) (UNC-5068)
PuC–UC, preparation, 18: 16049
PuC–UC, preparation and properties as reactor fuel material, 18: 16426(R) (UNC-5068)
PuC–UC, properties for use as reactor fuel in Rapsodie, 18: 17290(T) (AEC-tr-6359)
PuC–UC, radiation effects on crystal structure of, 18: 17351(R) (BMI-1659(Del.))
PuC–UC, radiation stability, 18: 17290(T) (AEC-tr-6359)
ThC–UC, preparation, 18: 16049
URANIUM COMPLEXES
with nitrates, spectra of, 18: 16029
URANIUM DEPOSITS
book: *Principal Characteristics of Uranium Geochemistry*, 18: 16221
geology of, book on, 18: 16222
URANIUM FLUORIDES
preparation and properties, 18: 16153
URANIUM(IV) FLUORIDES
reduction to metal using magnesium, 18: 16049
paraffin–UF_4, neutron multiplication in, 18: 16891(R) (GA-4881)
URANIUM(VI) FLUORIDES
decafluorobis(trifluoromethyl)cyclohexane–UF_6, vapor-liquid equilibria, 18: 15995 (K-271)
URANIUM IONS
reduction of hexavalent, by formic acid, catalytic, 18: 15997 (RT/CHI(63)-32)
URANIUM ISOTOPES
fission, 18: 16957(T) (AEC-tr-6371)
URANIUM ISOTOPES U-233
neutron fission of, kinetic energy of fragments in, 18: 16946 (NP-13654)
URANIUM ISOTOPES U-234
nuclear quadrupolar deformation, 18: 16949 (NP-13735)
URANIUM ISOTOPES U-235
determination in HTGR fuel compacts, automatic gamma scanner for, 18: 17265
fission fragment mass distributions from, thermal, 18: 16338
neutron fission of, energy balance for ternary thermal, 18: 17003

neutron fission of, energy distributions from, 18: 17100
neutron fission of, kinetic energy of fragments in, 18: 16946 (NP-13654)
separation from hydrogen gas moderator of gaseous-core rocket reactor, magnetohydrodynamic, 18: 17323

URANIUM ISOTOPES U-238
deuteron reactions (d,p) at 12 Mev, 18: 16912 (ANL-6848(p.52-62))
proton reactions with, nucleon cascades from, 18: 16974

URANIUM ISOTOPES U-239
energy levels, 18: 16912 (ANL-6848(p.52-62))

URANIUM MINERALS
properties of, book on, 18: 16222

URANIUM MOLYBDATES
PuO_2–UMO, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)

URANIUM NITRIDES
properties, 18: 16049
thermal stability, 18: 16473 (HW-SA-3370)
PuN–UN, thermal stability, 18: 16473 (HW-SA-3370)
Pu–UN, lattice parameters of solid solutions of, 18: 16473 (HW-SA-3370)
W–UN, preparation, 18: 17351(R) (BMI-1659(Del.))

URANIUM ORE PROCESSING PLANTS
radiation protection measures for, 18: 16240

URANIUM OXIDES
chlorination using phosphorus pentachloride, 18: 16130(T,R) (EURAEC-789)
fluorination of irradiated, 18: 16130(T,R) (EURAEC-789)
ionization by electron impact, appearance potentials of, 18: 16088
neutron resonance integrals for, 18: 16895 (NP-13662)
precipitation of complex hydrated, 18: 16009
preparation of sinterable, 18: 16064(P)

URANIUM OXIDES (STAINLESS STEEL CLAD)
decladding of, methods for, 18: 16153

URANIUM(IV) OXIDES
coating particles of, development of methods for, 18: 16049
diffusion of xenon from single crystals, 18: 16486(T,R) (EURAEC-969)
fluorination of irradiated, for plutonium and uranium recovery, 18: 16153
hydrofluorination in two-stage fluidized bed, continuous, 18: 16135
ionization by electron impact, appearance potentials of, 18: 16088
melting temperature, evaluation for space technology, 18: 16521
oxidation to uranium(IV-VI) oxide, determination of intermediate phases in, 18: 16037
preparation by reduction of uranium(VI) oxide, 18: 16049
preparation by reduction of uranyl compounds, 18: 16049
preparation of granular spheres of, with uniform particle size, 18: 16065(P)
production of sintered blocks of, for nuclear reactors, 18: 16463(P)
properties and impurities of powdered, 18: 17351(R) (BMI-1659(Del.))
reactions with boron carbide in flowing argon to 2200°C, effects of tungsten additions on, 18: 16468(R) (CEND-203)
testing of coated, 18: 17351(R) (BMI-1659(Del.))
thermal performance characteristics of, 18: 16422(R) (CEND-204)
xenon-133 release from irradiated pellets of, 18: 16524(R) (EURAEC-979)
B_4C–UO_2, thermodynamic properties to 2200°C, 18: 16468(R) (CEND-203)
Mo–UO_2, preparation, 18: 17351(R) (BMI-1659(Del.))
PuO_2–UO_2, burnup in fast reactors, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, properties for use as fuel element in Rapsodie, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, radiation stability, 18: 17290(T) (AEC-tr-6359)
PuO_2–UO_2, synthesis of carbon-stabilized, 18: 16426(R) (UNC-5068)
ThO_2–UO_2–Y_2O_3, properties and reactions of internal conversion fuel compositions of, 18: 16424(R) (GEMP-270A)
UO_2–ZrO_2, electric conductivity and thermal properties, 18: 17351(R) (BMI-1659(Del.))
W–UO_2, preparation, 18: 17351(R) (BMI-1659(Del.))

URANIUM(IV-VI) OXIDES
formation by uranium trioxide dissociation, 18: 16011
preparation by oxidation of uranium dioxide, determination of intermediate phases in, 18: 16037

URANIUM(VI) OXIDES
dissociation of alpha-, 18: 16011
preparation by calcination of ammonium polyuranate, 18: 16007(T) (AEC-tr-6377)
reduction to uranium dioxide, 18: 16049
PuO_2–UO_2, fluorination and oxidation, 18: 16130(T,R) (EURAEC-789)
UO_2–H_2O, effects of plutonium-240 on criticality of homogeneous, 18: 16736 (HW-79413)

URANIUM PEROXIDES
solubility in sulfuric acid, effects of acid concentration on, 18: 16012
solubility in water, effects of temperature on, 18: 16012

URANIUM PHOSPHIDES
magnetic properties, 18: 16488

URANOSPHERITES
synthesis, 18: 16009

URANYL IONS
preparation of tetravalent, by formic acid reduction of uranium(VI), catalytic, 18: 15997 (RT/CHI(63)-32)

URANYL NITRATES
bonding to hydrogen, determination of, 18: 16043(T)
thermal decomposition of hydrate of, 18: 16038

URIDINE
triphosphate, inhibitory effects on RNA polymerase, 18: 15751
uptake by HeLa cell DNA and RNA, effects of thymidine on, 18: 15802

URIDINES, 2'-DEOXY-
radiosensitivity effects on *E. coli*, 18: 15898

URINE
analysis of, sample preparation and counting methods for radiometric, 18: 15987
analysis of, sample preparation for, radiometric, 18: 15988
analysis of, sample preparation for radiometric, 18: 15989
analysis of, using autoradiography of paper chromatograms, 18: 15989
calcium-47 uptake by dog, effects of adrenal steroids on, 18: 15795
radiation effects on potassium and sodium content in rats, x, 18: 15842

UTERUS
fistula development after surgery and radiotherapy of carcinoma of, 18: 15839

V

V PARTICLES
production in meson (θ)-nucleon interactions, Lee model for, 18: 16778

VACCINES
preparation of tuberculosis, using gamma-irradiated bacteria, 18: 15824

VACUUM GAGES
design and performance of a-c gas-discharge, 18: 16278 (NP-13717)
design of radiometric, 18: 16395

VACUUM SYSTEMS
performance of Stanford storage ring, 18: 16587 (BNL-7534(p.209-27))

VACUUM VALVES
design of all-metal ultrahigh, 18: 16188(P)

VAGINA
radiotherapy of endometrial carcinoma of, survey on 610 cases of, treated using radium, 18: 15920

VAN ALLEN RADIATION BELTS
charged particle distribution in, 18: 16738(T) (FTD-TT-64-90(p.110-27))

VAN DE GRAAFF ACCELERATORS
design of 12-Mev tandem, 18: 16616
use as fast neutron source in activation analysis, 18: 15955 (NP-13761)
use as neutron source in activation analysis, 18: 15956 (NP-13762)

VANADIUM
alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
content in red giant stars, theory for, 18: 16634
determination in petroleum and its products, activation, 18: 15968
diffusion of chromium in, tracer studies of, 18: 16474 (NP-13738)
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
neutron spin-orbit scattering by monocrystalline, polarized, 18: 16894(R) (MIT-3031-1)
proton reactions with, lithium-6 and -7 fragments from, 18: 16977
reduction of pentaamine-cobalt(III) complexes by, kinetics of, 18: 16018
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by solvent extraction using butyl phosphates, 18: 16157(P)
sorption by cellulose ion exchangers from acetone and ethanol mixtures

with hydrochloric acid, 18: 16140
VANADIUM CARBIDES
bonding and vacancies in, 18: 16483(T) (AEC-tr-6374)
melting temperature, evaluation for space technology, 18: 16521
VANADIUM ISOTOPES V-51
gamma spectra of, low-energy, 18: 16980
proton reactions (p,n) with excitation functions for, 18: 16996
VANADIUM SILICIDES
superconductivity of crystalline V_3Si, neutron-diffraction analysis of, 18: 16894(R) (MIT-3031-1)
VANDENDRIESSCHEITES
synthesis, 18: 16009
VELA PROJECT
seismic data for CLEARWATER event, long-range, 18: 16189 (AD-427125(Rev.))
seismic data for SHOAL event, local, 18: 16190 (NP-13757)
seismic data from STONES event, long-range, 18: 16191 (NP-13586(Rev.))
VERMICULITES
sorptive properties for cesium and strontium, effects of aluminum and iron hydroxides and potassium on, 18: 17344
VIBRATION TESTING
response of linear lumped spring-mass systems to, graphical methods for, 18: 17360 (TID-18775)
VIBRATIONS
analysis of airborne, system for, 18: 16280 (SC-TM-328-62(72))
VINYL COMPOUNDS
radioinduced polymerization of, use for dosimetry of x and gamma radiation, 18: 16077 (NP-13734)
VIRIAL COEFFICIENTS
diagram expressions for, 18: 16548 (AERE-R-4494)
VIRUSES
effects of, on DNA synthesis in cells in irradiated tissue cultures, 18: 15835
radiation effects on cells producing Rous sarcoma, method for detection of, x, 18: 15838
VITAMIN B_{12}
cobalt-58-labeled, absorption by gastrointestinal tract, 18: 15799
uses of cobalt-60 labeled, for radiodiagnosis of chronic myelogenous leukemia, 18: 15914 (TID-7689(p.11-14))
VOLATILITY SEPARATION PROCESSES
development of halide, for processing irradiated fuels, 18: 16153

W

WASTE DISPOSAL
deep well, ion exchange in, 18: 17342
fixation in cement, injection methods for, 18: 17346
ground storage in U. S., review of, 18: 17337
ground storage, conditions for, 18: 17340
ground storage, evaluation of problems in, 18: 17338
ground storage, international program for, 18: 17339
ground, effects of climate on shallow-depth, 18: 17347
ground, geologic and hydrologic studies on, 18: 16207
land burial methods of, technical progress review on, 18: 17350
surface water, migration and retention in lithosphere from, 18: 17349
WASTE PROCESSING
calcination and solidification methods development, 18: 17332(R) (HW-80526)
calcination methods of, technical progress review on, 18: 17350
calcination of aluminum nitrate wastes in fluidized bed, 18: 17333 (IDO-14618)
foam separation methods, 18: 16129(R) (RAI-116)
foam separation methods of, technical progress review on, 18: 17350
ion exchange methods of, technical progress review on, 18: 17350
WASTE SOLUTIONS
decontamination of polonium process, 18: 16376(R) (MLM-1157)
separation of radioisotopes from, by ion exchange, 18: 17332(R) (HW-80526)
WATER
analysis for beta-emitting radioisotopes, 18: 15982
analysis for hydrogen peroxide, ultraviolet spectrophotometric, 18: 15948 (CEA-2391)
beta activity measurement in, reliability of techniques for, 18: 15979
boiling heat flux in, effects of induced whorls on critical, 18: 16183(T) (EURAEC-639)
bonding to clays, NMR study of, 18: 16031
corrosive effects on Zircaloy-2, additive effects of nitrogen, oxygen, and silicon on, 18: 16440 (WAPD-283)
determination of moisture content in top soil layer, prediction method for, 18: 16206 (USNRDL-TR-662)
droplet behavior on hot surface, 18: 16177(R) (TID-20133)
electron beam collisions with, emission spectra from, 18: 16700
heat transfer by, 18: 17322(R) (TID-19971)
hydroxyl radical split from, statistical model for angular momentum conservation for abnormal rotation of, 18: 16024
neutron backscattering by plane and spherical layers of, 18: 16896 (NP-13720)
neutron penetration through, fast, 18: 16891(R) (GA-4881)
neutron reactions (n,γ) with, dose distributions from, 18: 16962
proton reactions (p,γ) at 160 Mev, gamma spectra from, 18: 16315
radiation effects on rat consumption of, age effects on protons, 18: 15815 (USNRDL-TR-712)
radiolysis of, free radical formation by, 18: 16080
reactions with carbon dioxide and zinc, preparation of methane for tritium counting by, 18: 16075
thermal conductivity of gaseous, at 380 to 525°K, 18: 16020
water–water-d_2, vapor pressure equilibria in, 18: 15974
air–water, two-phase flows on four-rod assembly, effects of twist strips on, 18: 16182(T) (EURAEC-638)
H_2O–D_2O, thermal conductivity at 380 to 525°K, 18: 16020
steam–water, heat transfer to, flowing in heated tube, 18: 16171 (EURAEC-929)
UO_2–H_2O, effects of plutonium-240 on criticality of homogeneous, 18: 16736 (HW-79413)
WATER-d_2
deuterium-hydrogen exchange between chlorophyll and, location of, 18: 16042(T)
effects on growth of mint plants, 18: 15861
morphological effects in mice, 18: 15800
production by nitric acid–water countercurrent distillation, 18: 16405(P)
thermal conductivity of gaseous, at 380 to 525°K, 18: 16020
water–water-d_2, vapor pressure equilibria in, 18: 15974
H_2O–D_2O, thermal conductivity at 380 to 525°K, 18: 16020
phenol-d–water-d_2, vapor pressure, 18: 16066 (NP-13736)
WATER-t_2
tritium counting in, equipment and method for, 18: 15978
use for leak detection in heat exchangers in petroleum refinery, 18: 16389 (TID-7688(p.80-3))
WATER COOLED REACTORS
corrosion problems in, 18: 16445
economic evaluation of light, long-term, 18: 17306
fuel element development, 18: 16422(R) (CEND-204)
WATER MODERATED REACTORS
pressure vessel design with moderator-level regulator, 18: 17268(P)
WATER SUPPLIES
analysis from radioactivity in France, 18: 16204(R) (SCPRI(RM)-XII-1963)
production from wastes in shelters, evaluation of processes for, 18: 16228 (NP-13740)
WATER VAPOR
photoionization and absorption cross sections, 18: 16718
radiolysis of, formation of molecular hydrogen in gamma, 18: 16105
WEAR
measurement for machine parts by activation analysis, 18: 16165 (TID-7689(p.137-42))
WELDED JOINTS
mechanical properties, 18: 16458(T,R) (EURAEC-811)
WELDING
of refractory metals, effects of InFab atmosphere on, 18: 16450(R) (AD-431672)
techniques for steel pressure vessels, submerged-arc, 18: 16459(T,R) (EURAEC-962)
techniques for thick steels, 18: 16458(T,R) (EURAEC-811)
WELDING RODS
properties of steel, 18: 16458(T,R) (EURAEC-811)

WELDS
mechanical properties of filler, 18: 16458(T,R) (EURAEC-811)
thermal cycling effects on stainless steel wire-to-tube, 18: 16422(R) (CEND-204)
WELL LOGGING
methods for oil wells using radioactive fluid tracers, 18: 16192 (TID-7689(p.38-45))
WHEAT
cesium-137 and strontium-90 uptake from contaminated soil, 18: 15761
WHITE OAK CREEK
ruthenium flow in, 18: 17348
WIND TUNNELS
plasma flow in low-density hypersonic, gasdynamics of, 18: 17136
WIRES
fabrication from beryllium, 18: 16451(R) (AD-432273)
WOLSENDORFITES
synthesis, 18: 16009

X

X RADIATION
biological effects on brain development in rat embryos, comparison with nitrogen mustard, 18: 15834
biological effects on blood serum and enzymatic system of rabbits, 18: 15879
dose distribution in dogs, phantom measurement accuracy of, 18: 15753
dosimetry, problems in personnel, 18: 16364
effects of exposure of mice to, on aging of progeny, 18: 15808(R) (LAMS-3034(p.116-23))
effects of exposure for 15 generations to, on breeding characteristics of mice, 18: 15809(R) (LAMS-3034(p.124-8))
effects on bacteria, protective effects of nitric oxide against, 18: 15901
effects on cat brain, relation to craniocerebral injury, 18: 15818(T) (JPRS-23544)
effects on creatine excretion in thyroparathyroidectomized rats, 18: 15876
effects on dehydrogenases and transaminases in sporulating *B. subtilis*, 18: 15845
effects on DNA synthesis in viral-infected tissue cultures, 18: 15835
effects on dog immunity to anthrax, 18: 15858
effects on dog kidneys under high oxygen tension, 18: 15880
effects on dog sperm production, 18: 15892
effects on enzyme activity in extracts of tissue cultures, 18: 15831
effects on etching of quartz, 18: 16535
effects on glycogen content of dog and rabbit eyes, 18: 15837(T)
effects on human leukocyte chromosomes, 18: 15840
effects on immune reactions in guinea pigs, 18: 15825
effects on immune reactions in rabbits, 18: 15881
effects on immunological restoration by thymus in rats, 18: 15869
effects on lipids, protein, and glycogen in liver of guinea pig, 18: 15813 (NP-13733)
effects on mitotic delay in dog erythroblasts, 18: 15874
effects on morphology and physiology of rat spleen, 18: 15822
effects on mouse cerebellum, single high-level exposure, 18: 15830
effects on mouse chromosomes and sterility, 18: 15893
effects on mouse embryos, 18: 15891
effects on *p*-aminobenzoic acid solutions, 18: 16110
effects on polypropylene, ESR spectra of, 18: 16097
effects on Pseudomonas enzyme synthesis, 18: 15871
effects on rat central nervous system, 18: 15836(T)
effects on rat embryos, maternal role in, 18: 15894
effects on rat spleen, 18: 15863
effects on sex ratio shifts, 18: 15823
effects on sodium ion flux in human erythrocytes, 18: 15873
effects on structure of cadmium sulfides, 18: 16125
effects on subcellular responses in liver cells in culture, 18: 15864
effects on thermoluminescence of potassium chloride crystals, 18: 16083
effects on virus-producing sarcoma cells in chick embryos, 18: 15838
effects on volume expansion and color centers of sodium chlorides, 18: 16106
effects on volume expansion and coloration of LiF, 18: 16107
effects on yeast reactivation, 18: 15819(T) (UCRL-Trans-1029)
emission from hollow exploding aluminum wire, mechanisms of, 18: 16566
emission from solid electron targets, angular intensity distributions at surface, 18: 16685
emission from tungsten at 300 to 1100°K, interference maxima of, 18: 16687
genetic effects in mice, long-term, 18: 15812(R) (LAMS-3034(p.303-6))
leukemogenic effects in urethan-treated mice, protective effects of bone marrow against, 18: 15899
on pleural inflammation induced by Croton oil in guinea pigs, 18: 15877
population survey of exposure to, during diagnostic and dental radiography, 18: 16248
production of copper L-shell, by proton bombardment, 18: 16663
scattering by single crystals, broad diffuse bands from electron-lattice resonance in, 18: 16551 (TID-20364)
scattering factors for, analytical expressions for, 18: 16656
X-RAY CAMERAS
use of Berg-Barrett, for studying grains in alpha plutonium, 18: 16482 (UCRL-7651)
X-RAY EQUIPMENT
design of emission analyzer, 18: 16292(P)
development for low-dose diagnostic fluororadiography, 18: 15936
development of, in dental offices in Jefferson County, Alabama, 18: 16247
dose distribution using, 18: 15943
radiography specifications for, 18: 15930
sensitivity of films for evaluation of, 18: 15938
X-RAY MICROSCOPY
development of projection technique for coat fuel particles, 18: 17291
X-RAY MONOCHROMATORS
design and construction of, 18: 16287
X-RAY SPECTRA
angular distributions at surface of electron target, 18: 16685
isotope shifts in, formula for, 18: 17064(T)
XENIC ACID
reduction to xenon at dropping-mercury electrode, 18: 16053
XENON
diffusion from uranium carbide and uranium dioxide single crystals, 18: 16486(T,R) (EURAEC-969)
diffusion of hydrogen in, 18: 16054
electron capture by, excitation by, 18: 16709
formation by xenic acid reduction at dropping mercury electrode, 18: 16053
ionization by fission products, 18: 16740(R) (AD-425231)
photon absorption by, cross sections for, 18: 16717
potassium atomic beam scattering by, 18: 17121(R) (TID-20362)
separation methods evaluation for, chromatographic, 18: 16376(R) (MLM-1157)
XENON COMPOUNDS
preparation and properties of, review on, 18: 16050
XENON FLUORIDES
preparation, properties, and reactions of, review on, 18: 16050
XENON IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
XENON ISOTOPES Xe-133
release from irradiated uranium dioxide pellets, 18: 16524(R) (EURAEC-979)
use in tracer measurement of process gas flow rates, 18: 16387 (TID-7688(p.76-8))
XENON OXIDES
preparation and properties of tetravalent, 18: 16052
preparation and properties of, review on, 18: 16050

Y

YEASTS
phosphorus-32 transmutation efficiency in Saccharomyces, 18: 15870
radiation effects on reactivation in, x, 18: 15819(T) (UCRL-Trans-1029)
YTTERBIUM
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from gadolinium and samarium by zone crystallization in nitrate medium and by precipitation using ammonium oxalate, 18: 16137

YTTERBIUM FLUORIDES
NH_4F–YbF_3, chemical properties and crystal structure, 18: 16013
YTTERBIUM ISOTOPES
spectra of, shifts in x-ray, 18: 17064(T)
YTTERBIUM ISOTOPES Yb-169
decay of, energy levels from, 18: 16982
YTTERBIUM ISOTOPES Yb-172
gyromagnetic ratio, 18: 17095
YTTERBIUM ISOTOPES Yb-173
gyromagnetic ratio, 18: 17095
YTTERBIUM ISOTOPES Yb-174
gyromagnetic ratio, 18: 17095
YTTRIUM
effects on oxidation resistance of chromium, 18: 16423(R) (GEMP-197)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation from fission products by solvent extraction using D2EHPA, 18: 16147
solvent properties in D2EHPA hydrochloric acid, 18: 16147
YTTRIUM CHLORIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
YTTRIUM COMPLEXES
with Alizarin Red S, composition, nature, and stability of, 18: 16039
YTTRIUM FLUORIDES
chemical properties and crystal structure of, effects of temperature on, 18: 16013
YTTRIUM IODIDES
crystal lattice energy of, relation of self energy of gaseous ions to, 18: 16017
YTTRIUM IONS
van der Waals radii of, relation of hydration energy to, 18: 16016
YTTRIUM ISOTOPES Y-89
alpha scattering at 42 Mev, 18: 16951(R) (TID-20311)
neutron reactions with, scattering widths for resonance, 18: 17034
YTTRIUM ISOTOPES Y-90
movement in soils, method for study of, 18: 16216
separation from fission products by amalgam exchange, radiochemical, 18: 16148
therapeutic use, applicator needle for, 18: 15912(R) (ACRH-20(p.25-36))
YTTRIUM OXIDES
melting temperature, evaluation for space technology, 18: 16521
stabilization effects on thermal expansion of zirconium oxide at 200 to 2200°C, 18: 16500
CaO–Y_2O_3–ZrO_2, ionic conductivity of cubic solid solutions in, 18: 16014
ThO_2–UO_2–Y_2O_3, properties and reactions of internal conversion fuel compositions of, 18: 16424(R) (GEMP-270A)

Z

ZINC
alpha reactions (α,Li^6) with, 18: 16951(R) (TID-20311)
determination in petroleum and its products, activation, 18: 15968
Hartree-Fock potential of neutral atoms of, analytical expressions for, 18: 16656
ionization of, Auger effect in, 18: 16698
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
neutron elastic scattering at 0.3 Mev, angular distributions for, 18: 17090
reactions with carbon dioxide and water, preparation of methane for tritium counting by, 18: 16075
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
sorption by cellulose ion exchangers from acetone and ethanol mixtures with hydrochloric acid, 18: 16140
sorption from hydrochloric acid by cellulose and resin paper ion exchangers, 18: 16139
viscosity of liquid, 18: 16153
ZINC ALLOYS
Ca–Zn, solvent properties for plutonium and uranium, 18: 16153
Cd–Zn, radiation effects on contact melting of, 18: 16538
In–Zn, radiation effects on contact melting of, 18: 16538
ZINC ISOTOPES Zn-64
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
ZINC ISOTOPES Zn-65
electroplating on platinum electrodes, procedure for, 18: 16104
metabolism of, in rats, effects of dietary levels of copper and molybdenum on, 18: 15794
placental transfer of, in rats, 18: 15794
separation from fission products by amalgam exchange, radiochemical, 18: 16148
ZINC ISOTOPES Zn-66
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
ZINC ISOTOPES Zn-68
alpha inelastic scattering at 44 Mev, 18: 16925 (ANL-6848(p.137-42))
ZIRCALOY-2
compatibility with plutonium carbide–uranium carbide systems at 1100 and 1500°F, 18: 16426(R) (UNC-5068)
corrosion by steam and water, effects of nitrogen, oxygen, and silicon on, 18: 16440 (WAPD-283)
corrosion in water-cooled reactors, problems of, 18: 16445
creep-rupture properties of annealed and cold-worked, at 550, 650, and 750°F, 18: 16467(R) (BMI-X-277)
creep-rupture testing, 18: 17351(R) (BMI-1659(Del.))
dissolution by hydrofluoric acid, 18: 16152
hydrogen pickup in steam and water, effects of nitrogen, oxygen, and silicon on, 18: 16440 (WAPD-283)
ZIRCALOY-4
fabrication of projections on tubes of, 18: 17351(R) (BMI-1659(Del.))
ZIRCONIUM
bonding of, gas-pressure, 18: 17351(R) (BMI-1659(Del.))
corrosion by cesium at 1600°F, role of oxygen in, 18: 16447
effects on corrosion resistance and mechanical properties of beryllium, 18: 16448(P)
hydrogenation of, testing equipment and techniques for, 18: 16469(R) (EURAEC-821)
neutron elastic scattering at 0.65 Mev, angular distributions for, 18: 17089
oxidation by carbon dioxide at 400 to 750°C, additive effects on, 18: 16439 (CEA-2393)
properties as threshold detector, 18: 17278 (KAPL-M-6101)
radiation effects on mechanical properties, 18: 16525 (NP-13657)
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
separation by anion exchange in acetic acid–nitric acid medium, 18: 16131
separation by solvent extraction using butyl phosphates, 18: 16157(P)
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from hafnium and other materials by ion exchange, 18: 16155(P)
separation from other fission products by sorption on silica gel, 18: 16144
solvent properties in D2EHPA hydrochloric acid, 18: 16147
ZIRCONIUM ALLOYS
radiation effects on mechanical properties, 18: 16525 (NP-13657)
Be–Zr, corrosion resistance to carbon dioxide and mechanical properties, 18: 16448(P)
Mg–Zr, heat resistance, mechanical properties, and recrystallization of, 18: 16496
Mo–Nb–Zr, phase studies on, 18: 16494
Nb–W–Zr, phase studies on, 18: 16494
Nb–Zr, compatibility with plutonium carbide–uranium carbide systems at 1500°F, 18: 16426(R) (UNC-5068)
Nb–Zr, corrosion by liquid cesium, role of oxygen in, 18: 16447
Nb–Zr, production by fused salt electrolysis in sodium chloride–sodium fluoniobate–zirconium tetrafluoride, 18: 16431
Nb–Zr, use in accelerators and storage rings as superconductors, 18: 16602 (BNL-7534(p.417-47))
Pu–Zr, phase diagrams of, 18: 16493
Ta–W–Zr, phase studies on, 18: 16503
U–Zr, chlorination of irradiated, in reprocessing, 18: 16153
U–Zr, dissolution of Zircaloy-clad, using hydrofluoric acid, 18: 16152
U–Zr, properties as reactor fission rate detector, 18: 17278 (KAPL-

M-6101)
ZIRCONIUM BORIDES
melting temperature, evaluation for space technology, 18: 16521
radiation effects on mechanical properties of, 18: 16526 (NP-13663)
ZIRCONIUM CARBIDES
bonding and vacancies in, 18: 16483(T) (AEC-tr-6374)
melting temperature, evaluation for space technology, 18: 16521
preparation and properties of, 18: 16498
ZIRCONIUM FLUORIDES
KF–NaF–ZrF_4, phase diagram of, liquidus surface in, 18: 16008(T) (ORNL-tr-31)
NaCl–K_2NbF_7–ZrF_4, production of niobium–zirconium alloys by electrolysis of, 18: 16431
ZIRCONIUM ISOTOPES Zr-90
deuteron reactions (d,p) with, distorted-wave analysis of, 18: 16909 (ANL-6848(p.30-7))
electromagnetic monopole transitions in, partial widths for 2γ, 18: 16999
energy levels, 18: 16951(R) (TID-20311)
ZIRCONIUM ISOTOPES Zr-92
neutron reactions (n,α) at 14 Mev, 18: 17057
ZIRCONIUM ISOTOPES Zr-95
metabolism in mice, 18: 15768(R) (LAMS-3034(p.53-8))
separation from fission products by solvent extraction using D2EHPA, 18: 16147
separation from fission products by amalgam exchange, radiochemical, 18: 16148
ZIRCONIUM NITRIDES
preparation and properties of, 18: 16498
thermal stability, 18: 16473 (HW-SA-3370)
ZIRCONIUM OXIDES
diffusion of iodine and rare gases in, 18: 16424(R) (GEMP-270A)
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
thermal conductivity of foams of, for use above 3000°F, 18: 16520
thermal expansion of yttrium oxide-stabilized, at 200 to 2200°C, 18: 16500
Al_2O_3–CaO–MgO–ZrO_2, phase studies on, 18: 16490
CaO–Y_2O_3–ZrO_2, ionic conductivity of cubic solid solutions in, 18: 16014
UO_2–ZrO_2, electric conductivity and thermal properties, 18: 17351(R) (BMI-1659(Del.))
ZIRCONIUM SILICATES
properties of flame-sprayed coatings of, for use in space technology, 18: 16521
ZIRCONS
thermal conductivity of, for use above 3000°F, 18: 16520

REPORT NUMBER INDEX

Reports, numbered translations, and patents abstracted during the period are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(3rd Rev.), *Report Number Series Used by the Division of Technical Information in Cataloging Reports*, to be published.

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard and micronegative form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin 54669.

(4) Office of Technical Services, U. S. Department of Commerce, Washington, D. C. 20230, for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Office of Technical Services. Inquiries concerning "NP" reports should be by title and author rather than by report number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are deposited in the libraries listed on the inside covers of each issue of *NSA*.

Additionally, the following countries have made their reports available as indicated.

BELGIUM

Centre d'Etude de l'Energie Nucléaire. Available upon request to individuals and organizations, from the Centre d'Etude de l'Energie Nucléaire (CEN), 31, Rue Belliard Bruxelles, Belgium.

CANADA

Atomic Energy of Canada Limited. For sale by the Technical Information Officer, Atomic Energy of Canada Limited, Chalk River, Ontario, Canada. Copies are also deposited in libraries in the United Kingdom.

National Research Council of Canada. Available from the National Research Council of Canada, Ottawa 2, Ontario, Canada.

DENMARK

Atomic Energy Commission Research Establishment, Risö. Available on exchange from the Library, Danish Atomic Energy Commission, Risö, Roskilde, Denmark. Also for sale by Jul. Gjellerup, Booksellers, 87 Sölvgade, København K., Denmark.

Danatom. Available on loan from Research Establishment, Risö, Roskilde, Denmark. Copies are available upon request from Danatom, Strandvejen 102, Hellerup, Denmark.

FRANCE

Commissariat à l'Energie Atomique. Inquiries should be addressed to Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaires de Saclay, Boite Postale No. 2, Gif-sur-Yvette, Saclay, France.

GERMANY

Hahn-Meitner-Institut für Kernforschung. Available without charge from Hahn-Meitner-Institut für Kernforschung, Glienicker Strasse, Berlin-Wannsee, Germany, and from libraries in 18 other countries.

ISRAEL

Israel Atomic Energy Commission. Available without charge from Israel Atomic Energy Commission, Technical Information Department, P. O. Box 27, Rehovoth, Israel. Copies are deposited in libraries in Israel and other countries.

ITALY

Centro Informazioni Studi Esperienze (CISE). For sale at CISE Press Office, Casella Postale 3986, Milano, Italy. Copies are deposited in libraries in Italy.

JAPAN

Japan Atomic Energy Research Institute (JAERI). Available from the Staff Supply Cooperative of Japan Atomic Energy Research Institute (JAERI), 1-1 Tamura-Cho, Shiba, Minato-Ku, Tokyo, Japan. Copies are deposited in depositories in Tokyo, Nagoya, and Osaka.

NETHERLANDS

Reactor Centrum Nederland. For sale by Reactor Centrum Nederland, 112 Scheveningseweg, 's-Gravenhage, The Netherlands. Copies are deposited in university libraries in Holland and in many national nuclear centers in the world.

SPAIN

Junta de Energia Nuclear. "JEN" reports are available without charge from Department of Publications, Junta de Energia Nuclear, Serrano 121, Madrid, Spain.

SWEDEN

Aktiebolaget Atomenergi. "AE" reports are for sale from Aktiebolaget Atomenergi, Drottning Kristinas Vag 47, Stockholm Ö. Sweden. Other series are not available generally to the public. Organizations in the atomic energy field may obtain copies from Aktiebolaget Atomenergi. Microcopy of AE reports is available from the International Documentation Centre, Tumba, Sweden.

SWITZERLAND

CERN European Organization for Nuclear Research. Available without charge from CERN European Organization for Nuclear Research, Geneva 23, Switzerland. Copies are deposited in libraries in 13 countries.

UNITED KINGDOM

United Kingdom Atomic Energy Authority. Some reports are for sale in the United States by the British Information Service (BIS), 45 Rockefeller Plaza, New York, N. Y. 10022. United Kingdom reports generally may be purchased from Her Majesty's Stationery Office, London. Copies not for sale by Her Majesty's Stationery Office may be purchased in microcopy form from Micro Methods Limited, East Ardsley, Wakefield, Yorks, England. Report copies are deposited in a large number of libraries in England.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 45 Rockefeller Plaza, New York, N. Y. 10022.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both in and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin 54669.
	Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, London, N. W. 1, England.
DTI Extension	Available from the U.S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.
EM	Blueprints of AEC engineering drawings are available from the Oak Ridge Reproduction Service, Post Office Box 363, Oak Ridge, Tennessee. They are also available in photographically reduced form from Cooper-Trent, Inc., Wilson Boulevard at Danville Street, Arlington, Virginia 22210, and from the Rapid Blueprint Company, 818 Santee, Los Angeles, California 90014.
Gmelin	Available at a nominal charge and under the AED– number shown from Atomic Energy Documentation Center, Gmelin Institute, 40-42 Varrentrappstrasse, Frankfurt (Main), West Germany.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.
HMSO	Her Majesty's Stationery Office, London.
IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 35 West 33rd Street, Chicago, Illinois 60616.
LC	For sale by the Library of Congress, Photoduplication Service, Washington, D. C. 20540.
NAS	National Academy of Sciences, National Research Council, Washington, D. C. 20418.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
ORINS	Available on interlibrary loan from the Library, Oak Ridge Institute of Nuclear Studies, Post Office Box 117, Oak Ridge, Tennessee 37831.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington, D. C. 20230.
UKAEA, London	Available from United Kingdom Atomic Energy Authority, 11 Charles II Street, London, S. W. 1.
USGS	Available free-of-charge from the U. S. Geological Survey, Washington, D. C. 20242.

(The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.)

Report No.	Abstract No.	Availability
ACRH–		
20	18-15733	Dep.; $2.50(OTS)
20(p.1-24)	18-15749	Am. J. Med., 34: 796-?(1963)
20(p.69-75)	18-15750	Arch. Pathol., 72: 484-?(1961)
20(p.76-85)	18-15755	p.101-? of "The Medical Clinics of North America." Philadelphia, W. B. Saunders Co., 1963
20(p.86-8)	18-15752	Nature, 198: 902-?(1963)
20(p.132-5)	18-15751	Biochim. Biophys. Acta, 72: 116-?(1963)
AD–	(Misc.)	
283999	18-17104	See ARL-250(Pt.II)
416506	18-15994	$2.60(OTS)
416626	18-16547	$1.10(OTS)
416645	18-16202	
416807	18-16206	See USNRDL-TR-662
418403	18-17243	See GAMD-3690
425231	18-16740	$9.10(OTS)
427125(Rev.)	18-16189	
429190	18-15814	See USNRDL-TR-698
429954	18-16522	$2.60(OTS)
430410	18-16629	$2.60(OTS)
430641	18-15815	See USNRDL-TR-712
431025	18-17102	$3.60(OTS)
431548	18-16309	See USNRDL-TR-701
431615	18-16472	See HR-64-253
431640	18-17105	See BSD-TDR-64-6
431672	18-16450	$2.40(OTS)
431895	18-16741	See BSD-TDR-63-248
432170	18-17103	See ARL-64-6
432273	18-16451	$1.60(OTS)
434751	18-16474	See NP-13738
AEC-tr–		
6359	18-17290	Dep.(mc); $4.60(fs), $1.61(mf) JCL
6362	18-17365	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6363	18-17366	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6364	18-16180	Dep.(mc); $2.60(fs), $1.04(mf) JCL
6365	18-16235	Dep.(mc); $1.60(fs), $0.80(mf) JCL
6366	18-16428	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6371	18-16957	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6373	18-16530	Dep.(mc); $1.60(fs), $0.80(mf) JCL
6374	18-16483	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
6376	18-17367	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6377	18-16007	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
AEEW-R–	(British)	
183	18-17275	Dep.(mc)
248	18-17266	J. Nucl. Energy, Pts. A & B, 17: 481-90 (1963)
AERE-M–	(British)	
1178	18-16258	p.89-109 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963
1188	18-16360	p.305-17 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963
1332	18-16275	Dep.; $0.50(BIS); 2s. 6d. (HMSO)
AERE-R–	(British)	
3943	18-16465	Dep.; $1.20(BIS); 6s. (HMSO)
4277	18-16355	p.189-208 of "Personnel Dosimetry Techniques for External Radiation; Their Application in Nuclear Installations." Paris, European Nuclear Energy Agency, 1963
4494	18-16548	Dep.; $1.00(BIS); 5s. (HMSO)
AERE-Trans–	(British)	
997	18-16181	Dep.; $0.50(BIS); 2s. 6d. (HMSO)
AI-Trans–		
34	18-16484	Dep.(mc); $2.60(fs), $1.04(mf) JCL
37	18-17368	Dep.(mc); $1.10(fs), $0.80(mf) JCL
38	18-16531	Dep.(mc); $6.60(fs), $2.03(mf) JCL
41	18-16457	Dep.(mc); $2.60(fs), $0.86(mf) JCL
ANL–		
6785	18-16438	Dep.; $0.75(OTS)
6812	18-16076	Dep.; $0.50(OTS)
6848	18-16905	Dep.; $3.00(OTS)
ANL-Trans–		
4	18-17369	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
APDA–	(Misc.)	
158	18-17247	Dep.(mc); $6.60(fs), $2.27(mf) OTS
ARCRL–	(British)	
10	18-15735	Dep.(mc); $1.50(BIS); 7s. 6d. (HMSO)
ARL–	(Non-AEC)	
64-6	18-17103	$5.60(OTS)
250(Pt.II)	18-17104	$4.60(OTS)
ATN–	(Non-AEC)	
64(9232)-1	18-16549	
AWRE-O–	(British)	
87/63	18-16546	Dep.(mc)
BM-RI–	(Misc.)	
6391	18-16523	Free(Bureau of Mines)
BMI–	(Misc.)	
1659(Del.)	18-17351	Dep.; $1.50(OTS)
1664	18-16466	Dep.; $2.00(OTS)
BMI-X–		
277	18-16467	Dep.(mc); $1.60(fs), $0.80(mf) OTS
278	18-17248	Dep.(mc); $3.60(fs), $1.13(mf) OTS
BNL–		
6983	18-15843	J. Am. Dental Assoc., 68: 31-8(1964)
7019	18-15856	J. Immunol., 91: 761-70(1963)
7020	18-15873	Radiation Res., 21: 394-412(1964)
7159	18-15874	Radiation Res., 21: 413-22(1964)
7243	18-16778	Nuovo Cimento (10), 31: 599-614(1964)
7304	18-15753	Radiation Res., 21: 462-72(1964)
7529	18-16095	J. Phys. Chem., 68: 657-60(1964)
7534	18-16583	Dep.(mc); $23.50(fs), $14.69(mf) OTS
7609	18-16664	Phys. Rev., 134: A320-7(1964)
BRL-Memo–	(Misc.)	
1530	18-17258	Dep.(mc); $2.60(fs), $1.10(mf) OTS
BSD-TDR–	(Non-AEC)	
63-248	18-16741	$1.60(OTS)
64-6	18-17105	$3.60(OTS)
CAPE–		
993	18-17316	EM
1085	18-16288	EM
1096	18-17311	EM
1103	18-16187	EM
1107	18-16168	EM

Report No.	Abstract No.	Availability
CEA–	**(French)**	
2391	18-15948	Dep.(mc)
2393	18-16439	Dep.(mc)
2395	18-16163	Dep.(mc)
CEA-Bib–	**(French)**	
41	18-17289	Dep.(mc)
CEA-tr–	**(French)**	
A-1411	18-16079	Dep.(mc); $1.60(fs), $0.80(mf) JCL
R-1635	18-15816	Dep.(mc); $1.10(fs), $0.80(mf) JCL
X-319	18-17282	Dep.(mc); $2.60(fs), $0.98(mf) JCL
CEND–	**(Misc.)**	
203	18-16468	Dep.(mc); $2.60(fs), $0.95(mf) OTS
204	18-16422	Dep.(mc); $3.60(fs), $1.16(mf) OTS
CERN–	**(European Organization for Nuclear Research)**	
64-7	18-16605	Dep.(mc)
64-13(Vol.I)	18-16606	Dep.(mc)
64-13(Vol.II)	18-16607	Dep.(mc)
64-13(Vol.III)	18-16608	Dep.(mc)
CISE–	**(Italian)**	
35	18-17282	For translation see CEA-tr-X-319
CISE-R–	**(Italian)**	
75	18-16170	See EURAEC-896
78	18-16171	See EURAEC-929
86	18-16172	See EURAEC-951
CLM-P–	**(British)**	
30	18-17185	Proc. Phys. Soc. (London), 83: 121-36 (1964)
CNAEM–	**(Turkish)**	
14	18-16412	Dep.(mc)
CONF-39–	**(American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963)**	
109	18-17313	ORINS. Gmelin, AED-CONF-63-060-115
CONF-50–	**(American Ceramic Society 65th Annual Meeting, Pittsburgh, Apr.–May 1963)**	
20	18-16520	ORINS. Gmelin, AED-CONF-63-046-20
CONF-97–	**(American Institute of Aeronautics and Astronautics Conference, Los Angeles, June 1963)**	
24	18-16582	ORINS
CONF-99–	**(American Institute of Chemical Engineers, 49th National Meeting, New Orleans, Mar. 1963)**	
2	18-16521	ORINS. Gmelin, AED-CONF-63-017-8
CONF-133–	**(International Atomic Energy Agency Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963)**	
39	18-17277	See EUR-499.e
40	18-17276	See EUR-498.e
CONF-187–	**18-381**	**(American Nuclear Society Meeting, New York, Nov. 1963)**
79	18-17312	ORINS. Gmelin, AED-CONF-63-225-32
83	18-17256	ORINS. Gmelin, AED-CONF-63-225-20
105	18-16367	ORINS. Gmelin, AED-CONF-63-225-78
CONF-277–	**(Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963)**	
4	18-15910	ORINS. Gmelin, AED-CONF-63-257-2
5	18-15911	ORINS. Gmelin, AED-CONF-63-257-4
7	18-16269	ORINS. Gmelin, AED-CONF-63-257-7
8	18-16270	ORINS. Gmelin, AED-CONF-63-257-8
CONF-332–	**(Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla., Nov. 1963)**	
12	18-17330	ORINS. Gmelin, AED-CONF-63-215-9
CONF-346–	**(International Conference on Nuclear Physics with Reactor Neutrons, Argonne, Ill., Oct. 1963)**	
8	18-17100	ORINS. Gmelin, AED-CONF-63-201-8
CONF-373–	**(Technical Conference on Applied Aspects of Refractory Metals, Los Angeles, Dec. 1963)**	
5	18-16447	ORINS. Gmelin, AED-CONF-63-252-4
CONF-392–	**(Aerospace Sciences Meeting, New York, Jan. 1964)**	
2	18-17240	New York, American Inst. of Aeronautics and Astronautics, 1964, Preprint 64-8, $1.00. ORINS.
3	18-16581	New York, American Inst. of Aeronautics and Astronautics, 1964. Preprint 64-9, $1.00. ORINS.
17	18-16735	New York, American Inst. of Aeronautics and Astronautics, 1964, Preprint 64-66, $1.00. ORINS.
CONF-405–	**(4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964)**	
5	18-15945	See LADC-6084
CONF-413–	**(Proceedings of the Discussion Meeting Relative to the Planet Jupiter, New York, Oct. 1962)**	
1	18-16646	ORINS
CONF-414–	**(Conference on Direct Energy Conversion, Argonne, Ill., Nov. 1963)**	
3	18-16746	ORINS. Gmelin, AED-CONF-63-246-3
4	18-16745	ORINS. Gmelin, AED-CONF-63-246-10
CONF-417–	**(American Physical Society Meeting, Pasadena, Calif., Dec. 1963)**	
4	18-17101	ORINS. Gmelin, AED-CONF-63-253-16
6	18-17352	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-253-18
CONF-426–	**(IAEA Study Group Meeting on Research Reactor Utilization, Athens, Sept. 1963)**	
2	18-17286	ORINS
CONF-436–	**(10th International Congress on Radiology, Montreal, Aug.–Sept. 1962)**	
1	18-16366	ORINS; Com. Nucl. Energia Nucl. (Mex.), [Publ.], No. 158, 1-8(1964)
EIR–	**(Swiss)**	
60	18-17249	Dep.(mc)
ERR-AN–	**(Non-AEC)**	
174	18-16164	
EU-B–	**(German)**	
28	18-16486	For translation see EURAEC-969
EUR–	**(European Atomic Energy Community)**	
392.e	18-16556	Appl. Phys. Letters, 2: 140-2(1963)
498.e	18-17276	Dep.(mc)
499.e	18-17277	Dep.(mc)
585.i	18-15949	Dep.(mc)
587.e	18-15950	Dep.(mc)
596.e	18-16890	Dep.(mc)
EURAEC–		

Report No.	Abstract No.	Availability
638	18-16182	Dep.(mc); $9.10(fs), $3.38(mf) OTS
639	18-16183	Dep.(mc); $9.60(fs), $3.68(mf) OTS
721	18-16556	See EUR-392.e
789	18-16130	Dep.(mc); $4.60(fs), $1.58(mf) OTS
811	18-16458	Dep.(mc); $13.00(fs), $5.69(mf) OTS
821	18-16469	Dep.(mc); $5.60(fs), $1.94(mf) OTS
829	18-16485	Dep.(mc); $1.60(fs), $0.80(mf) OTS
883	18-16184	Dep.(mc); $1.60(fs), $0.83(mf) OTS
896	18-16170	Dep.(mc); $8.10(fs), $2.84(mf) OTS
910	18-17296	Dep.(mc); $6.60(fs), $2.09(mf) OTS
913	18-16470	Dep.(mc); $3.60(fs), $1.40(mf) OTS
929	18-16171	Dep.(mc); $8.60(fs), $3.08(mf) OTS
931	18-17251	Dep.(mc); $3.60(fs), $1.40(mf) OTS
951	18-16172	Dep.(mc); $6.60(fs), $2.12(mf) OTS
960	18-16442	Dep.(mc); $6.60(fs), $2.30(mf) OTS
962	18-16459	Dep.(mc); $6.60(fs), $2.12(mf) OTS
969	18-16486	Dep.(mc); $1.10(fs), $0.80(mf) OTS
978	18-16471	Dep.(mc); $1.60(fs), $0.80(mf) OTS
979	18-16524	Dep.(mc); $1.60(fs), $0.80(mf) OTS
984	18-16422	See CEND-204
985	18-16468	See CEND-203
FN-E-	**(Italian)**	
39	18-17296	See EURAEC-910
40	18-16524	See EURAEC-979
FTD-TT-	**(Non-AEC)**	
63-559	18-15786	OTS
64-90	18-16730	OTS
GA-	**(Misc.)**	
4804	18-16742	
4855	18-15951	
4881	18-16891	Dep.(mc); $3.60(fs), $1.34(mf) OTS
GAMD-	**(Misc.)**	
3690	18-17243	$6.60(OTS)
GEAP-	**(Misc.)**	
4388	18-17297	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GEMP-	**(Misc.)**	
197	18-16423	
270A	18-16424	Dep.; $2.75(OTS)
GEX-R-	**(French)**	
3	18-17303	For translation see NP-tr-1121
4	18-17304	For translation see NP-tr-1122
GLR-		
15	18-17322	See TID-19971
19	18-16177	See TID-20133
HR-	**(Non-AEC)**	
64-253	18-16472	$4.60(OTS)
HW-		
68600-35	18-17353	Dep.; $0.50(OTS)
79027	18-16297	Dep.(mc); $1.60(fs), $0.80(mf) OTS
79290	18-16452	Dep.; $1.00(OTS)
79291	18-16453	Dep.; $1.00(OTS)
79413	18-16736	Dep.(mc); $1.60(fs), $0.80(mf) OTS
79614	18-17317	Dep.; $1.75(OTS)
80092	18-17298	Dep.(mc); $1.60(fs), $0.80(mf) OTS
80213	18-16737	Dep.; $1.00(OTS)
80526	18-17332	Dep.; $0.75(OTS)
HW-SA-		
3370	18-16473	Dep.(mc); $1.10(fs), $0.80(mf) OTS
3409	18-17318	Dep.(mc); $4.60(fs), $1.67(mf) OTS
IDO-		
14618	18-17333	Dep.; $2.50(OTS)
16954	18-16942	Dep.; $1.25(OTS)
IPPJ-	**(Japanese)**	
17	18-17106	Dep.(mc)
IS-		
639	18-17354	Dep.(mc); $2.60(fs), $0.98(mf) OTS
676	18-16943	Dep.; $2.25(OTS)
764	18-16132	Anal. Chem., 36: 900-3(1964)
800	18-15952	Dep.; $2.00(OTS) Anal. Chem., 36: 1106-10(1964)
JAERI-	**(Japanese)**	
4027	18-16398	Dep.(mc)
5012	18-16223	
JPRS-	**(Non-AEC)**	
23544	18-15818	$0.50(OTS)
23834	18-15896	$1.75(OTS)
JüL-	**(German)**	
140-RX	18-16892	Dep.(mc)
145-TP	18-17107	Dep.(mc)
K-		
271	18-15995	Dep.(mc); $2.60(fs), $0.92(mf) OTS
1589	18-16298	Dep.; $0.50(OTS)
KAPL-M-		
6101	18-17278	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6119	18-16893	Dep.(mc); $8.10(fs), $2.72(mf) OTS
6121	18-16738	Dep.(mc); $4.60(fs), $1.43(mf) OTS
CHR-7	18-16647	Dep.(mc); $14.50(fs), $6.56(mf) OTS
JDJ-1	18-17279	Dep.(mc); $11.50(fs), $4.76(mf) OTS
KFK-	**(German)**	
189	18-16146	Radiochim. Acta, 2: 33-6(1963)
LA-		
3031	18-16276	Dep.; $0.50(OTS)
LADC-		
6045	18-16088	J. Chem. Phys., 40: 1632-7(1964)
6084	18-15945	Dep.(mc); $1.60(fs), $0.80(mf) OTS
LAL-	**(French)**	
1081	18-16609	Dep.(mc)
1091	18-16944	Dep.(mc)
LAMS-		
2977	18-16299	Dep.; $0.50(OTS)
3013	18-16760	Dep.; $1.50(OTS)
3034	18-15736	Dep.; $4.50(OTS)
LNF-	**(Italian)**	
63/72	18-16610	Dep.(mc)
MAN-Tkn-	**(German)**	
09-29-63-E	18-16184	For translation see EURAEC-883
MATT-		
176	18-17166	Phys. Fluids, 7: 511-19(1964)
197	18-17178	Phys. Fluids, 7: 615-16(1964)
200	18-17170	Phys. Fluids, 7: 543-7(1964)
207	18-17168	Phys. Fluids, 7: 532-6(1964)
MHD-	**(Non-AEC)**	
646	18-16743	

Report No.	Abstract No.	Availability
MIT–	**(Misc.)**	
1965-7	18-17355	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3031-1	18-16894	Dep.(mc); $1.10(fs), $0.80(mf) OTS
MLM–		
1157	18-16376	Dep.; $1.60(fs), $0.80(mf) OTS
1165(Tr)	18-15946	Dep.; $1.50(OTS)
MND-M–	**(Misc.)**	
1856	18-16225	Dep.(mc); $9.10(fs), $3.44(mf) OTS
1915	18-17299	Dep.(mc); $12.00(fs), $5.18(mf) OTS
NAA-SR–		
6310	18-17319	Dep.(mc); $3.60(fs), $1.19(mf) OTS
7541	18-16739	Dep.; $0.75(OTS)
9265	18-17300	Dep.; $2.75(OTS)
NASA-SP–	**(Non-AEC)**	
3008	18-17244	
NASA-TN–	**(Misc.)**	
D-2264	18-16277	$0.50(OTS)
NASA-TT–	**(Non-AEC)**	
F-175	18-17122	$4.00(OTS)
NBS-MON–	**(Misc.)**	
68	18-15996	$0.25(GPO)
NIRL-R–	**(British)**	
56	18-16761	Dep.(mc); $0.70(BIS); 3s. 6d. (HMSO)
NMI–	**(Misc.)**	
7019	18-16454	Dep.(mc); $1.60(fs), $0.80(mf) OTS
NP–	**(AEC File No. for Non-AEC Reports)**	
13499	18-17301	Dep.(mc)
13586(Rev.)	18-16191	
13601	18-16945	Dep.(mc)
13609	18-17108	Dep.(mc)
13612	18-17109	Dep.(mc)
13619	18-16381	Dep.(mc)
13623	18-17110	Dep.(mc)
13654	18-16946	Dep.(mc)
13656	18-16173	Dep.(mc)
13657	18-16525	Dep.(mc)
13659	18-17259	Dep.(mc)
13660	18-16174	Dep.(mc)
13661	18-16947	Dep.(mc)
13662	18-16895	Dep.(mc)
13663	18-16526	Dep.(mc)
13666	18-17287	Dep.(mc)
13687	18-16226	
13691	18-16227	Dep.(mc)
13693	18-16304	Dep.(mc)
13694	18-16762	Dep.(mc)
13696	18-17111	Dep.(mc)
13697	18-17112	Dep.(mc)
13698	18-17113	Dep.(mc)
13701	18-16763	Dep.(mc)
13705	18-17114	Dep.(mc)
13706	18-17115	Dep.(mc)
13710	18-17325	Dep.(mc)
13711	18-17116	Dep.(mc)
13712	18-16175	Dep.(mc)
13717	18-16278	Dep.(mc)
13720	18-16896	Dep.(mc)
13730	18-15895	
13731	18-16764	Dep.(mc)
13732	18-16948	Dep.(mc)
13733	18-15813	Dep.(mc)
13734	18-16077	Dep.(mc)
13735	18-16949	Dep.(mc)
13736	18-16066	Dep.(mc)
13738	18-16474	$2.60(OTS) as AD-434751
13739	18-16648	
13740	18-16228	
13741	18-16425	
13743	18-17117	Dep.(mc)
13744	18-17118	Dep.(mc); Phys. Letters, 9: 141-4(1964)
13746	18-16279	$0.35(GPO)
13748	18-16305	
13755	18-16475	
13756(Vol.I)	18-17334	Dep.(mc)
13756(Vol.II)	18-17335	Dep.(mc)
13757	18-16190	
13759	18-16476	
13760	18-16229	Dep.(mc)
13761	18-15955	
13762	18-15956	
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
1114	18-16958	Dep.(mc); $2.60(fs), $0.89(mf) JCL or OTS
1121	18-17303	Dep.(mc); $1.60(fs), $0.80(mf) JCL
1122	18-17304	Dep.(mc); $1.60(fs), $0.80(mf) JCL
NRC–	**(Canadian)**	
7729	18-15974	Can. J. Chem., 42: 710-11(1964)
NRL-Memo–	**(Misc.)**	
1393	18-16527	
NSEC–		
72	18-17320	Dep.(mc); $8.10(fs), $2.69(mf) OTS
NYO–		
2930-1	18-16176	Dep.(mc); $5.60(fs), $1.82(mf) OTS
9324	18-16128	Dep.(mc); $3.60(fs), $1.22(mf) OTS
10496	18-16203	Dep.(mc); $5.60(fs), $1.82(mf) OTS
ORNL–		
3485	18-16649	Dep.; $1.75(OTS)
3539	18-16455	Dep.; $2.25(OTS)
3546(Suppl.1)	18-17260	Dep.; $1.00(OTS)
3555	18-16159	Dep.; $1.00(OTS)
3588	18-16477	Dep.; $1.10(fs), $0.80(mf) OTS
ORNL-TM–		
348	18-17326	Dep.(mc); $21.00(fs), $10.88(mf) OTS
515	18-16377	Dep.(mc); $1.60(fs), $0.80(mf) OTS
579	18-17356	Dep.(mc); $8.60(fs), $2.93(mf) OTS
ORNL-tr–		
31	18-16008	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
32	18-16443	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
OTS–	**(Misc.)**	
64-21724	18-15818	See JPRS-23544
64-21875	18-15896	See JPRS-23834
PAN-O–	**(Polish)**	
117	18-17250	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
949,073	18-17314	
949,171	18-16627	
949,172	18-16628	
950,627	18-16405	
951,120	18-16271	
951,227	18-17268	
951,647	18-16368	
951,658	18-17331	

Report No.	Abstract No.	Availability
951,687	18-16289	
951,791	18-16406	
951,896	18-17269	
951,966	18-16369	
952,011	18-17270	
952,088	18-17241	
952,090	18-17293	
952,200	18-17315	
952,246	18-16154	
952,265	18-16188	
952,304	18-16462	
952,328	18-16169	
952,335	18-16126	
952,488	18-16448	
952,499	18-16063	
952,558	18-17271	
952,561	18-16272	
952,604	18-16370	
952,856	18-16064	
952,859	18-16127	
952,927	18-16155	
952,948	18-16273	
952,977	18-17294	
PATENTS	**(Czechoslovakian)**	
100,179	18-17242	
PATENTS	**(German)**	
22,462	18-16463	
1,086,680	18-16079	For translation see CEA-tr-A-1411
1,154,793	18-16156	
PATENTS	**(U. S.)**	
3,125,123	18-17272	
3,125,160	18-17273	
3,125,410	18-16157	
3,125,416	18-16435	
3,125,418	18-16436	
3,125,421	18-16437	
3,125,493	18-17295	
3,125,688	18-16290	
3,126,033	18-17274	
3,126,250	18-16065	
3,126,258	18-16158	
3,126,267	18-16407	
3,126,322	18-17257	
3,126,323	18-16449	
3,126,430	18-16464	
3,126,477	18-16291	
3,126,479	18-16292	
3,126,481	18-16371	
3,126,482	18-16372	
3,126,483	18-16373	
3,126,484	18-16274	
PATENTS	**(U.S.S.R.)**	
149,231	18-16396	
155,568	18-16374	
155,881	18-16375	
RAI–	**(Misc.)**	
116	18-16129	Dep.(mc); $4.60(fs), $1.61(mf) OTS
RT-CHI–	**(Italian)**	
(63)-32	18-15997	Dep.(mc)
RT-FI–	**(Italian)**	
(63)-48	18-17119	Dep.(mc)
(63)-49	18-17120	Dep.(mc)
RT-PROT–	**(Italian)**	
(63)-13	18-15957	Dep.(mc)
RTI-ING–	**(Italian)**	
(63)-5	18-17321	Dep.(mc)
S–	**(Misc.)**	
237-R	18-16305	See NP-13748
SC–	**(Misc.)**	
4929(RR)	18-16161	Dep.; $2.00(OTS)
SC-DC–		
3240	18-17360	See TID-18775
64-346	18-16528	Dep.(mc); $7.60(fs), $2.60(mf) OTS
64-378	18-17357	Dep.(mc); $2.60(fs), $0.98(mf) OTS
SC-T–		
64-46	18-16310	Dep.(mc); $1.60(fs), $0.80(mf) JCL
64-45	18-17371	Dep.(mc); $1.10(fs), $0.80(mf) JCL
64-44	18-17370	Dep.(mc); $1.60(fs), $0.80(mf) JCL
SCDC–		
3111	18-16898	See TID-18327
3113	18-16899	See TID-18328
SCL-TM–		
64-34	18-17359	Dep.(mc); $1.10(fs), $0.80(mf) OTS
SCPRI(RM)–	**(French)**	
XII-1963	18-16204	Dep.(mc)
SCPRI(S)–	**(French)**	
81	18-15958	Dep.(mc)
94	18-15959	Dep.(mc)
SC-R–		
685	18-17358	Dep.; $1.50(OTS)
SC-TM–		
328-62(72)	18-16280	Dep.(mc); $1.60(fs), $0.80(mf) OTS
SGAE-PH–	**(Austrian)**	
2/1964	18-16950	Dep.(mc)
3/1964	18-16306	Dep.(mc)
CH-1/1964	18-15960	Dep.(mc)
SSD-TDR–	**(Non-AEC)**	
63-98	18-16878	$2.60(OTS)
TDR–	**(Non-AEC)**	
169(3250-1)TN-1	18-16878	See SSD-TDR-63-98
TID–		
4005(Pts.3&4) (Rev.2)	18-16413	Dep.; $3.50(OTS)
7688	18-16382	Dep.(mc); $9.60(fs), $3.80(mf) OTS
7689	18-16378	Dep.; $2.50(OTS)
18327	18-16898	J. Math. Anal. and Appls., 8: 144-69 (1964)
18328	18-16899	J. Math. Anal. and Appls., 8: 170-4 (1964)
18603	18-16232	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18775	18-17360	Dep.(mc); $11.00(fs), $4.52(mf) OTS
18923	18-16148	Radiochim. Acta, 2: 99-103(1963)
19023	18-17174	Phys. Fluids, 7: 586-95(1964)
19455	18-17061	Nucl. Phys., 51: 518-27(1964)
19462	18-17060	Nucl. Phys., 51: 481-517(1964)
19573	18-17052	Nucl. Phys., 51: 395-400(1964)
19971	18-17322	Dep.(mc); $9.60(fs), $3.59(mf) OTS
20133	18-16177	Dep.(mc); $2.60(fs), $0.95(mf) OTS
20182	18-16919	See ANL-6848(p.108-13)

Report No.	Abstract No.	Availability
20311	18-16951	Dep.(mc); $5.60(fs), $1.82(mf) OTS
20313	18-16952	Dep.(mc); $7.60(fs), $2.57(mf) OTS
20326	18-16480	Dep.(mc); $12.00(fs), $5.15(mf) OTS
20336	18-16178	Dep.(mc); $1.60(fs), $0.80(mf) OTS
20339	18-16004	Dep.(mc); $2.60(fs), $0.83(mf) OTS
20347	18-15758	Dep.(mc); $1.95(fs), $1.18(mf) OTS
20352	18-16953	Dep.(mc); $1.60(fs), $0.80(mf) OTS
20353	18-17361	Dep.(mc); $2.60(fs), $0.83(mf) OTS
20354	18-16005	Dep.(mc); $1.10(fs), $0.80(mf) OTS
20355	18-17362	Dep.(mc); $22.25(fs), $13.52(mf) OTS
20362	18-17121	Dep.(mc); $3.60(fs), $1.28(mf) OTS
20363	18-17363	Dep.(mc); $5.60(fs), $1.79(mf) OTS
20364	18-16551	Dep.(mc); $1.60(fs), $0.80(mf) OTS
20366	18-15759	Dep.(mc); $3.60(fs), $1.13(mf) OTS
20368	18-16233	Dep.(mc); $1.60(fs), $0.80(mf) OTS
20369	18-16205	Dep.(mc); $2.60(fs), $1.07(mf) OTS
TR–	**(Misc.)**	
1167	18-16522	See AD-429954
TRW-ER–	**(Misc.)**	
5075	18-17319	See NAA-SR-6310
5802	18-16744	
UCID–		
1800	18-16160	See UCRL-11200(Vol. 1)
UCRL–		
7246	18-17171	Phys. Fluids, 7: 548-56(1964)
7391	18-16285	IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-11: No. 1, 345-50(1964)
7492	18-16666	Phys. Rev., 134: A345-6(1964)
7541	18-16663	Phys. Rev., 134: A316-20(1964)
7544	18-17302	Dep.; $0.75(OTS)
7559	18-16481	Dep.; $4.50(OTS)
7618	18-15963	Dep.; $0.50(OTS)
7619	18-16414	Dep.; $0.50(OTS)
7624	18-16897	Dep.; $0.75(OTS)
7651	18-16482	Dep.; $0.50(OTS)
7657	18-16162	Dep.; $1.25(OTS)
7692-T	18-16791	Phys. Rev. Letters, 12: 340-2(1964)
10906	18-15927	Diabetes, 12: 490-501(1963)
10925	18-16651	Dep.; $1.50(OTS)
11124	18-16006	Dep.; $0.50(OTS)
11132	18-16552	Dep.; $2.25(OTS)
11143	18-16954	Dep.; $2.25(OTS)
11179	18-17364	Dep.; $3.50(OTS)
11183	18-16790	Phys. Rev. Letters, 12: 336-40(1964)
11200(Vol.1)	18-16160	Dep.; $5.00(OTS)
UCRL-Trans–		
992(L)	18-17372	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
1026(L)	18-16652	Dep.(mc); $5.60(fs), $1.73(mf) JCL or OTS
1029	18-15819	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
1030(L)	18-16487	Dep.(mc); $1.60(fs), $0.80(mf) JCL
1031	18-16555	Dep.(mc); $1.60(fs), $0.80(mf) JCL
1032	18-16653	Dep.(mc); $3.60(fs), $1.28(mf) JCL
1033	18-17373	Dep.(mc); $1.10(fs), $0.80(mf) JCL
1043(L)	18-17374	Dep.(mc); $1.60(fs), $0.80(mf) JCL
UJ–	**(Czechoslovakian)**	
929/63	18-16007	For translation see AEC-tr-6377
UNC–	**(Misc.)**	
5068	18-16426	Dep.(mc); $2.60(fs), $0.86(mf) OTS
USNRDL-TR–	**(Non-AEC)**	
662	18-16206	$5.60(OTS)
698	18-15814	$3.60(OTS)
701	18-16309	$7.60(OTS)
712	18-15815	$2.60(OTS)
715	18-16234	$3.60(OTS)
VDIT–	**(Swedish)**	
16(4.1)	18-16529	Dep.(mc)
WADD-TR–	**(Non-AEC)**	
61-72(Vol.XXIII)	18-16186	
WAPD–	**(Misc.)**	
244	18-16427	Dep.; $1.00(OTS)
283	18-16440	Dep.(mc); $1.00(OTS)
WAPD-T–		
1597	18-17292	J. Nucl. Energy, Pts. A & B, 17: 551-7 (1963)
WCAP–	**(Misc.)**	
2056(Pt.I)	18-16441	Dep.(mc); $10.10(fs), $4.07(mf) OTS
2056(Pt.II)	18-16179	Dep.(mc); $5.60(fs), $1.94(mf) OTS
2526	18-16166	Dep.(mc); $10.10(fs), $3.92(mf) OTS
2540	18-15964	Dep.(mc); $3.60(fs), $1.40(mf) OTS
6059	18-17280	Dep.; $2.50(OTS)
WERL–		
63-927-115-R1	18-16952	See TID-20313
ZFK-PHA–	**(German)**	
5	18-16611	Dep.(mc)
ZFK-RCH–	**(German)**	
1	18-16401	Dep.(mc)
ZFK-RN–	**(German)**	
8	18-17261	Dep.(mc)
ZFK-TPH–	**(German)**	
1	18-16955	Dep.(mc)
5	18-17281	Dep.(mc)
7	18-16956	Dep.(mc)

DEPOSITORIES OF USAEC REPORTS

In Countries Other than the U.S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität

BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire

BOLIVIA
La Paz, Comisión Nacional de Energiá Nuclear

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo

BURMA
Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library

CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile

CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University

COLOMBIA
Bogota, Instituto De Asuntos Nucleares

COSTA RICA
San Pedro, University of Costa Rica Library

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Santo Domingo, Comisión Nacional de Asuntos Nucleares

ECUADOR
Quito, Escuela Politécnica Nacional

EGYPT
Cairo, Atomic Energy Commission

EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library

ENGLAND (CONT.)
Newcastle upon Tyne, Central Library
Nottingham, Central Library
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences

GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

GHANA
Accra, University College of Ghana

GREECE
Athens, Nuclear Research Center "Democritus"

GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University

IRAN
Tehran, Tehran University Center for Nuclear Studies

IRAQ
Baghdad, Iraqi Atomic Energy Commission

IRELAND
Dublin, University College

ISRAEL
Rehovoth, Israel Atomic Energy Commission

ITALY
Rome, Centro di Studi Nucleari della Casaccia
Rome, Comitato Nazionale per l'Energia Nucleare

JAPAN
Tokyo, National Diet Library

KOREA
Seoul, Office of Atomic Energy

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MALAYA
Kuala Lumpur, University of Malaya

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, City Library

NORWAY
Lilleström, Institutt för Atomenergi

PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre

PERU
Lima, Junta de Control de Energia Atomica

PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission

POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej

PORTUGAL
Sacavem, Junta de Energía Nuclear

REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library

REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear, Biblioteca Documentación y Publicaciones, Ciudad Universitaria

SWEDEN
Nyköping, Aktiebolaget Atomenergi

SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

URUGUAY
Montevideo, Comision Nacional de Energia Atomica

VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Científicas

VIET-NAM
Dalat, Institute of Nuclear Research, Atomic Energy Office

YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, La Bibliotheque EURATOM

FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.

ITALY
Ispra, EURATOM Research Center

SWITZERLAND
Geneva, United Nations Library

UNITED STATES
Washington, D. C., Inter-American Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300